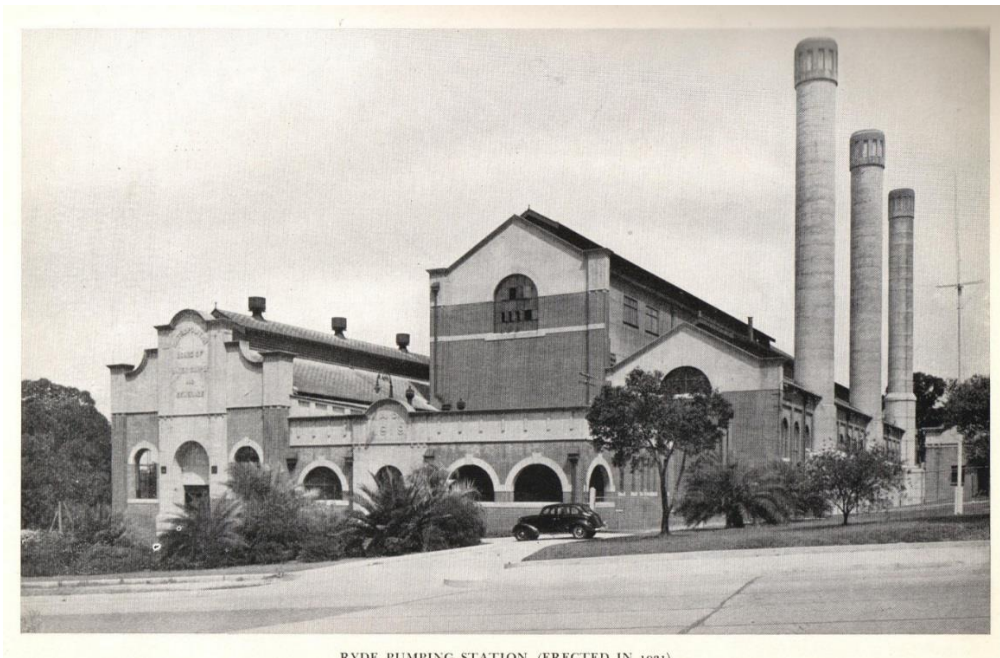


NOMINATION FOR ENGINEERING HERITAGE RECOGNITION

Ryde Water Pumping Station



RYDE PUMPING STATION (ERECTED IN 1921).



Ryde Water Pumping Station is a landmark within the Ryde area of Sydney and is valued for its technical, historical and aesthetic cultural heritage significance.

The site of the Ryde Water Pumping Station was chosen to deliver water to the city's northern suburbs. These suburbs may be defined as being north of Sydney Harbour and north of Parramatta River.

The *Ryde Water Pumping Station* is of high operational importance in Sydney's water supply system.



Illustrating Pumping Station No. 2 (2008)

This proposal for *Ryde Water Pumping Station* to be recognised for its heritage significance has been prepared by Phil Bennett and Simon Wiltshier on behalf of the Engineering Heritage Committee (Sydney).

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INTRODUCTION

Reference to the **Ryde Water Pumping Station** generally means the whole site but where relevant the two pumping stations are referred to as **Pumping Station No.1** and **Pumping Station No.2**.

Position of Ryde Water Pumping Station within Development of Sydney Water

Ryde Water Pumping Stations No.1 and No.2 were created as part of the Upper Nepean Water Supply Scheme which developed from the late 1860s. The scheme, largely in use today, was based on the gravitational supply of water from the Nepean, Cataract, Cordeaux and Avon Rivers to the Prospect Reservoir. From Prospect the water is channelled to Potts Hill Reservoirs from where it is distributed to different parts of Sydney.

In 1888, when the Water Board was constituted, a single 48in (c.1220mm) main led from Potts Hill to Sydney supplying Petersham and Crown Street reservoirs. This main was doubled in the following years and supplied most areas of Sydney including the Lower North Shore via a submarine 9in main under the harbour from Paddington reservoir.

In 1891, a 24in main was added to supply the newly opened Ryde Water Pumping Station No. 1 which supplied the majority of the new suburbs being built to the north of the harbour. Another important main was also added around this time to supply the south suburbs of Sydney, then referred to as the Illawarra area. Several other branches were added in the early 1890s for direct supply of areas around Parramatta.

The density of the pipeline network increased as the population of Sydney grew over the decades. The Ryde branch remains one of the three most important geographical subsystems connected to Potts Hill Reservoir.

Water Pumping Stations

Ryde Water Pumping Station No.1 was completed in 1891. Chronologically, it was the sixth water pumping station in Sydney area and the fourth major permanent pumping station. Like the other early pumping stations, Ryde Water Pumping Station No.1 was steam-powered.

The first water pumping station in Sydney was installed in 1854 at the Lachlan Swamps (Centennial Park) which pumped water into Busby's Bore. The next major pumping station built was at Botany Bay, housing three 100hp engines, used within the Botany Swamps scheme. The Crown Street pumping station was built in 1879 with the purpose of lifting water to the Woollahra and Paddington Reservoirs.

Other early examples of pumping stations in Sydney include the small plant added to the Woollahra Reservoir in 1886 to pump water to the Waverley Reservoir and the temporary station at Junction Street, North Sydney which operated from 1888-1892. The Junction Street station which was supplied from Crown Street via a submarine pipe preceded Ryde in supplying water to the North Shore suburbs. Each of the three major early water pumping stations were at the time of their creation the largest in the Sydney system.

The importance of the Ryde Water Pumping Station was due to its role as being the major water supplier for one of the three geographical subsystems connected to the Upper Nepean Scheme and thus as the main supply for one third of the Sydney Metropolitan area.

The Ryde Water Pumping Station No.1 was also the first in Australia to house steam turbine engines. The station was also said to be Australia's first to have its own electric power generators that were sufficient for its independent operation. The importance of the Ryde site was emphasized in 1921 when Station No.2 was completed. The 1921 pumping station was thought to be the largest steam-powered water pumping station in Australia. Like its predecessor, this relatively late example of a coal fired, steam powered water pumping station relied on its own independent power generating system. Pumping Station No.2 used pulverised coal for boilers which is considered innovative for the time and the station's pneumatic ash collecting system was described as 'state of the art'.

Architecturally, the Pumping Station No.1 was a very fine example of a public utility building with prevailing characteristics of the Victorian Free Classical style. The adjoined brick chimney, featuring a polychromatic pattern, was aesthetically one of the finest items of its type ever created in the Sydney Water system.

Pumping Station No.2 features the Federation Freestyle architectural style. The building is a good representative example of this style amongst the surviving public utility buildings. The Pumping Station No.2 building is not *rare* in its aesthetics or relative architectural complexity, as many other important examples survive like Chatswood Reservoir's Pumping Hall (1895) and the Waterloo Pumping Station (1922-1924).

The structure of the Pumping Station No.2 is an early example of Australian-made structural steel. The Station also featured reinforced concrete chimneys created as an early use of this material for the construction of industrial stacks. There are other surviving examples including the Ventilating Shafts at Burwood (1919) and Croydon (1922) and are listed on the State Heritage Register. Both remain in the ownership of Sydney Water.

During the late 1960s, Ryde Water Pumping Station was the last remaining steam-powered station in the Sydney Water system. At this time, the Major Electric Pumping Station Group were administered within the Mechanical Branch. A number of other minor water pumping stations were administered by the Operations Branch.

HERITAGE AWARD NOMINATION FORM

The Administrator
Engineering Heritage Australia
Engineers Australia
Engineering House
11 National Circuit
BARTON ACT 2600

Name of work:

Ryde Water Pumping Station

The above-mentioned work is nominated for an award under the Heritage Recognition Program of Engineers Australia.

Location, including address and map grid reference if a fixed work:

.....
.....
.....

Owner (name & address):

.....
.....
.....

The owner has been advised of this nomination and a letter of agreement is attached.
Access to site:

.....
.....
.....

Nominating Body:

.....
.....

Chair of Nominating Body
Date:

.....
Chair of Divisional EHA Group
Date:

HERITAGE ASSESSMENT

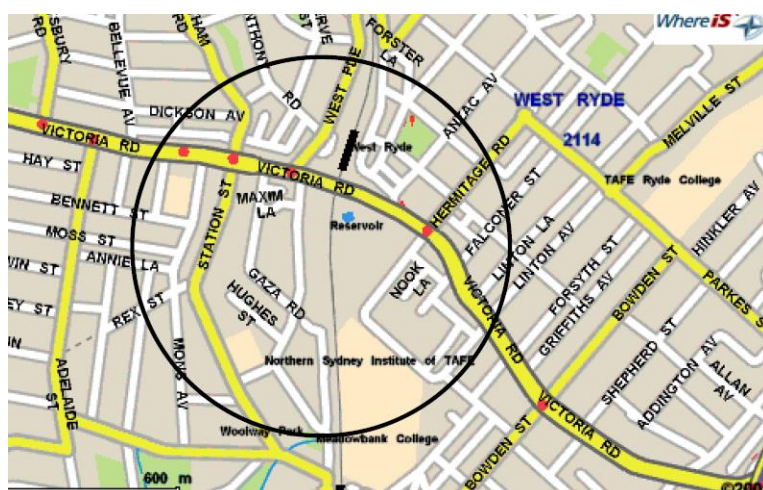
BASIC DATA

Ryde Water Pumping Station is a complex of buildings, structures and landscape elements.

Item name: Ryde Water Pumping Station

Other / former names: Water Pumping Station 5, WP5, WP0005, Ryde Pumping Station and Site and West Ryde Water Pumping Station

Location: The corner of Hermitage and Victoria Roads; 948-956 Victoria Rd, West Ryde; 51 Hermitage Rd, West Ryde.



Suburb / Nearest Town: West Ryde

State: New South Wales

Local Government Area: Ryde

Owners: Sydney Water Corporation

Current Use: Water pumping station.

Former Use (if any):

Designer: NSW Public Works

Year Started: 1918 **Year Completed:** 1921 **Years of Operation:** 1921- ongoing

Physical Description: Pumping station, boiler house (former), economiser hall (former) engineer's accommodation, amenities

Physical condition: Good

The condition of the remaining built and natural items on the site varies according to their age, history of use, maintenance and other factors.

Extensive conservation works have been made to the boiler and economiser houses, the coal staithe and the rail viaduct between 2005 -7.

Modifications and Dates: Conversion to electricity 1981

Historical Notes: (see details)

Heritage Listings: NSW State Heritage Register, Sydney Water's Section 170 Heritage & Conservation Register, Ryde Local Council's LEP Heritage List (Item No.105) and National Trust of Australia (NSW) Register.

ASSESSMENT OF SIGNIFICANCE

(This assessment is in addition to that already found on the NSW State Heritage Register entries – refer Attachment 4.)

Historical Phase: Ryde Water Pumping Station has unique associations with the historical development of Sydney being the key element in water supply for large parts of the northern metropolitan area.

Ryde Water Pumping Station's development and subsequent operation were closely connected with the activities of Public Works Department as the construction authority until the mid-1920s and the State Railways as the provider of access for coal until the 1970s.

Ryde Water Pumping Station has strong associations with the historical development of Sydney Water Corporation (Water Board). It is among the largest and oldest continuously occupied Sydney Water properties and the largest water pumping station in Sydney's water supply system.

Ryde Water Pumping Station contains archaeological evidence of the Water Pumping Station No.1 completed in 1891 which was the largest water pumping station in Australia at the time.

Historical Individuals or Associations: Ryde Water Pumping Station has connection with important engineers, builders and Public Works Department.

Ryde Water Pumping Station was initially independent of the Board although the Engineer-in-Chief would report on a monthly basis to the Board. Marine engineers were always employed to manage the pumping station.

Creative or Technical Achievement: Ryde Water Pumping Station including both Pumping Station No.1 and Station No.2 was subject to regular testing of new technology. This resulted in the successful application of new technology and the abandonment of unsuccessful technology. It also demonstrated a willingness to utilise Australian technology and materials.

Ryde Water Pumping Station No.1 was associated with technological advancements and trial of the first steam turbine driven water pumps used in Australia, introduction of forced draught and automatic pneumatic control in the stokehold, change from manual to automatic ash disposal, installation of water tube boilers, use of higher pressure steam than previously available and the adoption of telemetric reservoir gauging.

Pumping Station No.1 housed what are considered to be the first steam turbine driven water pumps used in Australia being installed in 1908. The Stirling boilers (installed 1906) also introduced water tube boilers.

Ryde Water Pumping Station No.2 demonstrated innovative design and technologies including the innovative coal delivery system, use of pulverised coal fuel for boiler, state of the art pneumatic ash collection, early example of use of electrically welded steam piping (1921) and the early example of use of cement spray rendering (1923).

Ryde Water Pumping Station capacity evolved from pumping some 12 million gallons (55 Mega litres) of water per day to 20 million gallons (91 Mega litres) per day with the expansion of the site to include Pumping Station No.2 to pump 66 million gallons (300 Mega litres) per day by 1956 prior to amplification works undertaken in 1958.

Research Potential: Ryde Water Pumping Station No 2 has some research potential as the steam powered technology of the time was applied to a large water pumping station that could pump to different locations. It had an innovative coal delivery system and utilised pulverised coal fuel for the boilers. It also featured a pneumatic system for ash collection that was state-of-the-art at the time.

The early examples of particular technologies used on Ryde Water Pumping Station include electrically welded steam piping (1921) and the cement spray (Cement Gun) rendering (1923).

Social: Ryde Water Pumping Station has been a significant employer in the district. Up until 1978, Ryde Water Pumping Station No. 2 employed 50 men, including the efficiency engineer, maintenance engineer, nine shift duty pumping engineers, engine room attendants, firemen, ashmen, bricklayers, boiler makers, coal fitters, painters, an electrician, a boiler-maker, a locomotive driver and assistant and labourers.

A large proportion of staff employed at Ryde had previously worked building Warragamba Dam and were from a variety of non-English speaking backgrounds. No women were employed until the changeover to electric power when a female apprentice electrician joined the station.

Rarity: Ryde Water Pumping Station No. 2 is rare as it contains the only known example of a coal delivery system that has the coal dropped from the wagons (via railway and staithe) into the hoppers that are directly above the boilers.

Ryde Water Pumping Station No. 2 is the largest water pumping station in NSW, servicing over 700,000 households. At the time of construction, it was considered to be the largest water pumping station in the southern hemisphere.

Representativeness: Ryde Water Pumping Station No.2 is a late and representative example of a Federation Freestyle utility building and is representative of large steam powered water pumping stations used in the late 19th and early 20th century.

Important components of Ryde Water Pumping Station survive, including the Pumping Station No.1 group (surge tank, original valve house and Engineers residence) and Pumping Station No. 2 group (engine house, boiler house, coal staithe, economiser house, rail viaduct, efficiency engineer's office and paint shop).

Integrity / Intactness: The integrity of Ryde Water Pumping Station is high as it continues to operate for the purpose it was designed.

Ryde Water Pumping Station has never ceased to operate and has been adapted during significant periods in Australian history including the Depression and World War II.

Ryde Water Pumping Station No. 2 is almost completely intact although the former boiler house, economiser house, rail delivery system and associated functions are obsolete. The pump hall continues to operate although the pumps and associated equipment has been continuously upgraded.

Statement of Significance: Ryde Water Pumping Station and site is of high cultural significance to the State of NSW for the important role it serves in the history of water supply in Sydney.

The site has association with Pumping Station No. 1, the 1891 steam-powered pumping station that operated from 1891-1930 and was demolished in 1961.

Ryde Water Pumping Station No.2 is a late and representative example of a Federation Free style utility building. Ryde Water Pumping Station No.2 is representative of large steam powered water pumping stations used in the late 19th and early 20th century. Ryde Water Pumping Station No.2 was opened in 1921 and was originally powered by steam until its conversion to electric power in 1976-81. At its completion Ryde Water Pumping Station No.2 was the largest water pumping station in Australia. While much of the plant and equipment has been removed and replaced, it retains considerable fabric allowing previous work practices to be interpreted from earlier periods. It remains one of the largest and longest operating water pumping stations in Sydney. It maintains the overall function and values it was designed for.

Ryde Water Pumping Station features evidence of numerous past and present technological processes. The place includes buildings, works, archaeological evidence, machinery and equipment, sheds and cultural landscape elements (including paths, drives, plantings etc.). Ryde Water Pumping Station site contains important landscape elements and has the ability to demonstrate important and distinct phases of its history.

Ryde Water Pumping Station continues to make an important contribution to the local townscape and serve as an outstanding landmark group.

Assessed Significance: State

Images with captions: included in document



Illustrating Pumping Station No. 2, Admin and Boiler House from Victoria Rd (2008)



Illustrating Pumping Station No. 2 – Pump Hall from Victoria Rd (2008)

SOURCES

Rosen, S., (2000) *Ryde Water Pumping Station Site Conservation Management Plan*, Draft Report prepared for Sydney Water.

Sydney Water Corporation, *Ryde Pumping Station and Site Conservation Management Plan* (2005)

A detailed chronological history of the two Ryde Water Pumping Stations, No.1 & No.2, taken from the 1990 study by C & MJ Doring, *Ryde Water Pumping Station 1891 – 1991 Heritage Study*, is included in this report.

A full list of studies that are relevant for further research is attached in the Bibliography.

HISTORICAL OVERVIEW

Ryde Water Pumping Station (Pumping Stations No.1 & No.2) is an integral element of Sydney's water supply system and has continually pumped water to the city's northern regions since 1892.

Position within the Water System

The Ryde Water Pumping Station forms part of the network of pumps, reservoirs and pipes that provide water to the northern suburbs of Sydney.

Water is sourced from Sydney's major dams including Warragamba, Cataract, Nepean, Avon and Cordeaux and sent to Prospect for treatment. Originally, water was supplied to Ryde Water Pumping Station via gravity from the Potts Hill site but by 1903 with the installation of a new main water came directly from the Guildford (Pipe-head) site, also via gravity. From Pipehead, water is distributed to several major reservoirs and water pumping stations including the reservoir at Potts Hill and water pumping stations at Waterloo, Crown Street, South Dowling Street and Ryde.

Ryde Water Pumping Station pumps water to a number of reservoirs including Chatswood, Killara, Mobbs Hill, Hermitage and Pymble. From these reservoirs the water is either fed by gravity to surrounding suburbs or pumped to other reservoirs.

Ryde Water Pumping Station is a vital element in the water supply system in the areas to the north of the Harbour and provides water to about 700,000 households in greater Sydney.

Organisational History

Frequent water shortages in Sydney and subsequent public complaints led to the creation of the Board of Water Supply and Sewerage (the Board) in 1888. Prior to this reorganisation, provision of a fresh water supply was the domain of Sydney City Council.

Major works were constructed by the Harbours and Rivers and Water Supply Division of the Public Works Department (PWD). Ryde Water Pumping Station No. 1 was built just prior to the reorganisation of the PWD and the creation of the Water Conservation, Irrigation and Drainage Section in 1892.

After 1888, the Public Works Department retained its role in construction for the Board but later most of this was later taken over by the Board. Pumping Station No.1 was built by the Public Works Department. It was demolished in the 1961.

Pumping Station No. 2 was built by the Board.

Early Water Supply Schemes

The origins of Sydney's water supply is recognised as the stream that attracted Captain Arthur Phillip in 1788 to set up the colony's first settlement on Sydney Cove. The stream which became known as the Tank Stream due to cutting 'tanks' out of the bedrock of the stream was an unreliable source. By 1826, this stream eventually became so polluted it ceased to be used for water supply.

After the Tank Stream had been exhausted, the second source of freshwater was the Lachlan Swamps that delivered water to the city via the convict-built Busby's Bore tunnel. This was the first piped water supply and the Colony's first major engineering project. In 1854, this scheme included a steam pumping station that was installed at the lower end of the Lachlan Swamps. The pumping station was needed to push more water through the bore to meet the needs of a growing population.

In 1858, more water was needed for the growing city. The Botany Swamps was transformed into the third water supply. In 1859, the Botany water pumping station was constructed which pumped freshwater to Crown Street Reservoir from 1859 to 1895.

By 1867, increasing population and pressures of drought necessitated a Commission appointed by the Governor to recommend a new scheme to supply a reliable and sufficient water supply.

In 1869 the Commission recommended the Upper Nepean Scheme which utilised the waters of the Nepean River and its tributaries, the Cataract, Cordeaux and Avon Rivers. The implementation of the new Upper Nepean Scheme did not start until 1879 due to the lack of funds. The scheme became partly effective in 1886 and was approved by the Commission in 1888. In 1884 and 1885 severe drought reduced Botany's water reserves to a level sufficient for only ten days of average consumption. Pressure was acute necessitating the construction of an emergency scheme to supplement the water in the Botany Swamps.

The 1885/1886 emergency system known as Hudson Brothers' Temporary Scheme after the engineering company that built it was completed in six months and it provided 13,000 Megalitres a day to the Botany Swamps. It was in use between 1886 and 1888. It was abandoned and dismantled after the completion of the Upper Nepean Scheme in 1888.

The Upper Nepean Water Supply Scheme

The Upper Nepean Scheme took water from the Nepean River and its tributaries the Avon, Cataract, and Cordeaux rivers. A system of tunnels, canals and aqueducts known as the Upper Canal directed water towards Prospect Reservoir from where it was taken via the Lower Canal to Pipe Head in Guildford. At Pipe Head water was piped to Potts Hill and to Crown Street Reservoir.

The Upper Nepean Scheme was expanded through creation of the supplementary dams including the Upper Nepean Dams between 1907 and 1935, Warragamba Dam in 1960 and Tallowa Dam in 1977.

In total, the Upper Nepean Scheme includes 16km of tunnel, 66km of open channel and 8km of wrought iron pipeline. Numerous elements of the Scheme including Prospect Reservoir, major parts of the Upper Canal and some of the mains laid in the 1880s are still in use today. The Lower Canal has been decommissioned and is now used as a cycleway. Prospect Reservoir is used as a back-up supply only. The upper Nepean Scheme continues to operate today.

Originally, water was supplied to Ryde Water Pumping Station via gravity from the Potts Hill site but by 1903 with the installation of a new main water came directly from the Guildford (Pipe-head) site also via gravity.

Northern Water Distribution System

The northern system water distribution system has Ryde Water Pumping Station at its centre. It is essentially separate from the southern suburbs distribution system but both systems are supplied from the Upper Nepean Scheme via Potts Hill or Pipe-head in Guildford.

At the time of the establishment of the Board in 1888 the main point of the distribution of Sydney's water supply was Crown Street pumping station in Surry Hills. This served the city and suburbs south of the harbour. A limited water supply to the North Shore was provided from Paddington reservoir by a 9-inch cast iron submarine main which crossed the harbour from Dawes Point to Milson's Point.

In response to urgent requests to supply water to the higher reaches of North Sydney a temporary pumping station was built at North Sydney in 1888. This was dismantled in 1892 when Ryde Water Pumping Station No 1 became operational and the original water main was abandoned in 1917.

By 1887 it had been decided to build Ryde Water Pumping Station No.1 north of the Parramatta River and connected to the Upper Nepean Scheme at Potts Hill. The scheme, constructed by the Public Works Department was completed and handed over to the Board in 1892. In 1903, the suction source was changed from Potts Hill to Pipe-head which remains today.

Water from Ryde Pumping Station No. 1 was pumped into a wrought iron tank on Ryde Hill and into two wrought iron tanks at Chatswood. The Ryde Hill tank supplied Ryde, Gladesville and Hunters Hill and a branch main supplied Balmain. The Chatswood tanks supplied North Sydney, Mosman and Willoughby.

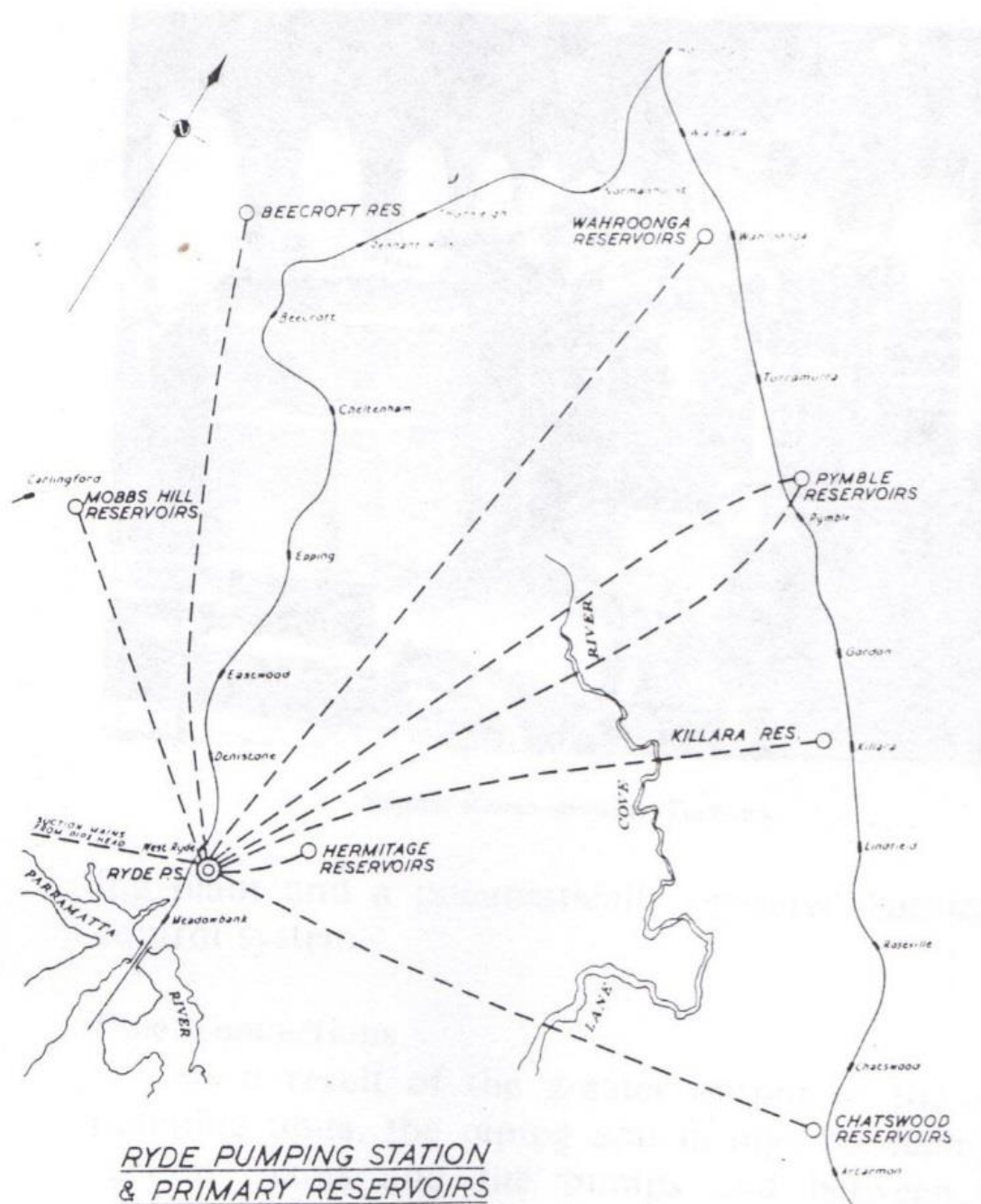


Fig. 2.

Illustrating the Northern system – from *Ryde Water Pumping Station*

RYDE WATER PUMPING STATION NO. 1.

Resumption of Land

Land for the Ryde Water Pumping Station was gradually acquired from 1887 over a period of 35 years. The first European landowner of the site was William Kent who possessed several grants, the smallest some 100 acres which included the subject site. This lot was leased to Wolfenden Kenny in 1822 after Kent died at sea in 1812.

The 100 acres passed to Michael Gannon in trust for Morris and Margaret Reynolds. In 1847 it was transferred to John Blaxland, eldest son of the explorer and agriculturalist Gregory Blaxland. John Blaxland was a prominent figure in the Ryde district being involved in local politics and owner of The Hermitage at the corner of Blaxland Road and Anzac Avenue. The site is not known to have any special association with the explorer other than being part of his large portfolio of land holdings.

As late as 1900, the district was dominated by some seven or eight families and the Church of England who owned most of the land. By 1908, Blaxland's son, Frederick Blaxland, was the sole owner of the 100 acres of the subject site.

Early subdivisions of Kent's 100 acre land grant

In 1887, Kent's 100 acre land grant was sub-divided. The property adjacent to Ryde Railway Station and north of Victoria Road becomes Miriam Hill Estate and part of the property south of Victoria Road was resumed for Ryde Water Pumping Station and transferred to the PWD. This property was apparently vacant remaining in its forested state.

The 1892-4 Map of the Municipality of Ryde, shows the portion of the 100 acres resumed for Ryde Water Pumping Station No.1 and the parcels owned by Blaxland that were later resumed for Pumping Station No.2.

Real estate activity had slowed in the depression of the 1890s allowing utilities to catch up with the pace of development. Local houses were connected to water mains in 1892, gas arrived in 1893 and telephone connections by 1899.

Establishment of Pumping Station No. 1. (1891)

The Department of Public Works were planning for the construction of the Ryde Pumping Station No. 1 as early as 1888. Factors that determined the location of the pumping station included the completion in 1891 of the railway from Strathfield to Hornsby that passed through Ryde and the completion in 1895 of the railway linking Milsons Point and Hornsby. Also significant was the completion in 1889 of the Hawkesbury River rail bridge that provided access to the Hunter coalfields and hence fuel for the steam plant. By 1890, construction of the pumping station had commenced as had the 24-inch supply main to Ryde from Potts Hill and the reservoirs at Ryde and Chatswood.

In 1887, at the commencement of construction of the Ryde Pumping Station No 1 the Ryde railway station goods loop siding was extended into the site.



Illustrating Station No.1 being built. (c1890).



Illustrating Station No.1 completed (c1891)



Illustrating Station No.1 with second Boiler House addition (post 1906)



Illustrating Station No.1 with second engine house (post 1916)

Boiler House and Engine House

The initial configuration of Pumping Station No.1 was a 'T' shape with the engine house facing Victoria Road and the original Boiler House forming the leg extending south and parallel to the railway line. The chimney was built off the east wall of the Boiler House.

The first engine house was brick building built in the Italianate style and was completed in 1890. The principal decorative element of the building was the polychromatic detailing of the brickwork. The walls were burnt brick with cream brick diamonds under the eaves and cream brick panels. The main roof of the engine house was hipped with a clerestory wooden louvered ventilator along the ridge. A similar style was adopted for Ryde Pumping Station No.2.

The first boiler house and chimney were completed in 1891. Although the Boiler House was a more modest structure it also featured the polychromatic brickwork. Like the Engine House the Boiler House roof was clad in galvanised iron. The chimney, completed in 1891, was constructed from brick with a sandstone base. The brickwork of the chimney matched the polychrome brickwork of the pumping station building. The chimney was octagonal and stood to a height of 120 feet. It was demolished in the 1950s.

In 1906, the station was expanded with a second Boiler House and the first Boiler House was converted to an Engine House. A Green's economiser was installed. The second Boiler House was built in the same polychrome brickwork. The original *Cornish* boilers were replaced by five new *Stirling* Boilers in the second Boiler House. At this time the coal and ash handling plant was installed including a conveyor tower.

In 1909, four cylindrical coal storage bins (or silos) were constructed to the immediate south of the pumping station and adjacent to the railway siding. They were linked by an overhead conveyor to the Boiler House. The construction of the coal bins necessitated the demolition of one of two firemen's cottages which had first appeared on a Water Board plan in 1902.

In 1916, a second Engine House (Allen Engine House) was built on the west side of the first Engine House. It was a weatherboard building and it was known as the auxiliary plant. This plant was required to adequately fill Chatswood service reservoir, its completion having been delayed by WW1.

Machinery & Operation

A full chronological history of the plant, pumping and steam utilised at Pumping Station No.1 compiled by Doring & Doring in 1991 and is attached to this report. The major plant infrastructure is summarised below is based on the Doring report.

Steam Plant

The first four steam boilers installed were Colonial brand hand fired boilers. These were presumably demolished when replaced by five Stirling boilers in 1906. In 1914, two Babcock and Wilcox boilers were added as backup to the Stirling boilers and these were augmented by an additional two Babcock and Wilcox boilers in 1916.

The steam plant is described in the 1916 Metropolitan Board of Water Supply and Sewage commemorative handbook for the opening ceremony of the auxiliary pumping plant (Allen engine):

These boilers supply steam to the engines at a pressure of 150 lbs per sq. in. and are fired by Mechanical Chain Grate Stokers, the coal being automatically fed to the grates from steel plate overhead bunkers; these bunkers and the four reinforced concrete storage bins are replenished with coal, and the ashes are removed from the ash-pits by means of a bucket conveyor. Coal is delivered in trucks on the Board's siding, and after being shovelled into the receiving hopper is automatically conveyed to the bunkers, and thence by gravity to the grates, or may be delivered into the storage bins and withdrawn as required, to replenish the bunkers by the same mechanical means of transport... The total coal storage is 1000 tons.

The gases of combustion after heating the boilers are passed through a Green's Economiser in which the feed water is heated ... before entering the boilers. Flue draft is accelerated ... by an Induced Draft Plant, consisting of a ... sirocco Fan, which delivers the flue gases into the ... brick chimney. (MBWSS, 1916)

Pumping Plant

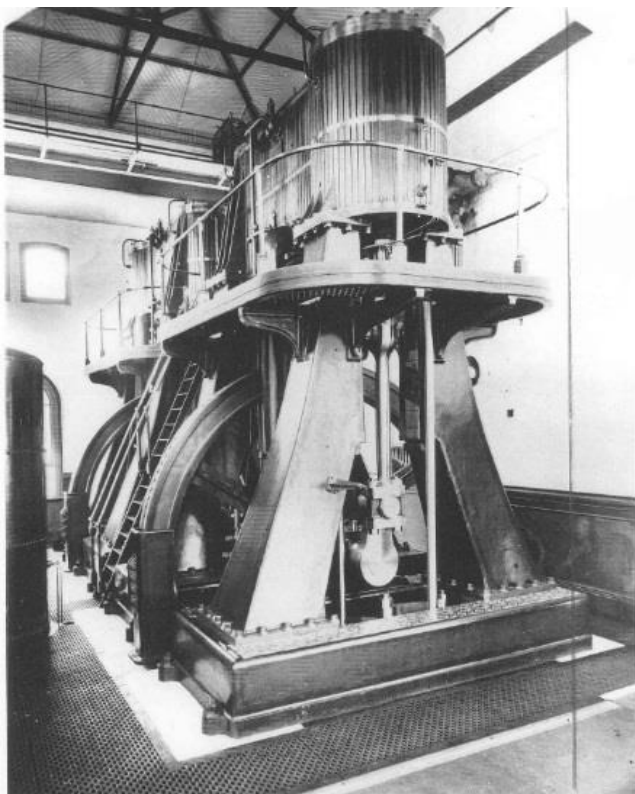
The first pumps installed in Ryde Pumping Station No.1 were two large J Watt & Co. (Birmingham) vertical pumping engines that extending from the floor to the roof of the building. These pumped to a one million gallon wrought iron tank at Ryde Hill which supplied the two tanks at Chatswood.

In 1906, two Parsons turbo-centrifugal pumps and two Gwynne's centrifugal pumps were installed. These pumped to the Pymble and Hermitage reservoirs.

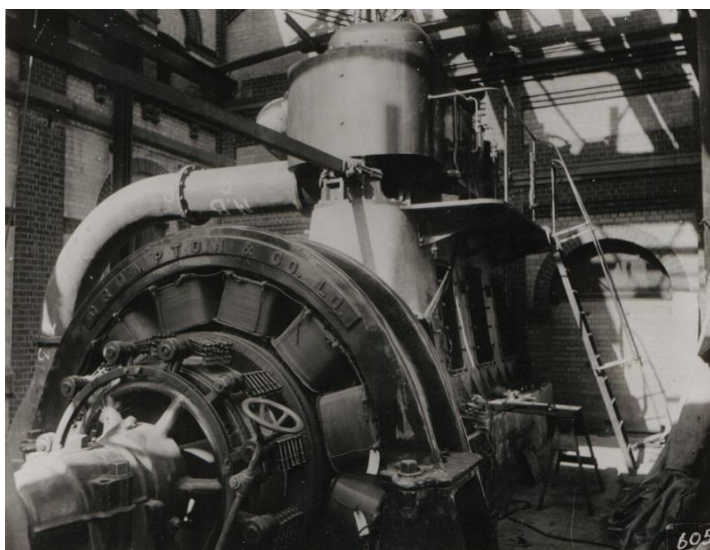
In 1910, Austral Otis triple expansion duplex pumps were tested but proved unsuitable and were dismantled and sold a year later. The reliable Parsons steam turbine with three Worthington (US) pumps were installed to replace the Austral Otis pumps in 1911. The use of the Melbourne-based Austral Otis pumps thus established a pattern of adopting and testing new technology and Australian products.

An Auxiliary Electro-centrifugal plant was installed in 1916 using a steam piston Allen Engine coupled to a Crompton Electric Generator. The Allen engine was purchased from Melbourne City Council where it had been used by the 'Municipal Electrical Works'. This Engine was eventually transferred to Potts Hill in 1922 where it continued to operate until 1965.

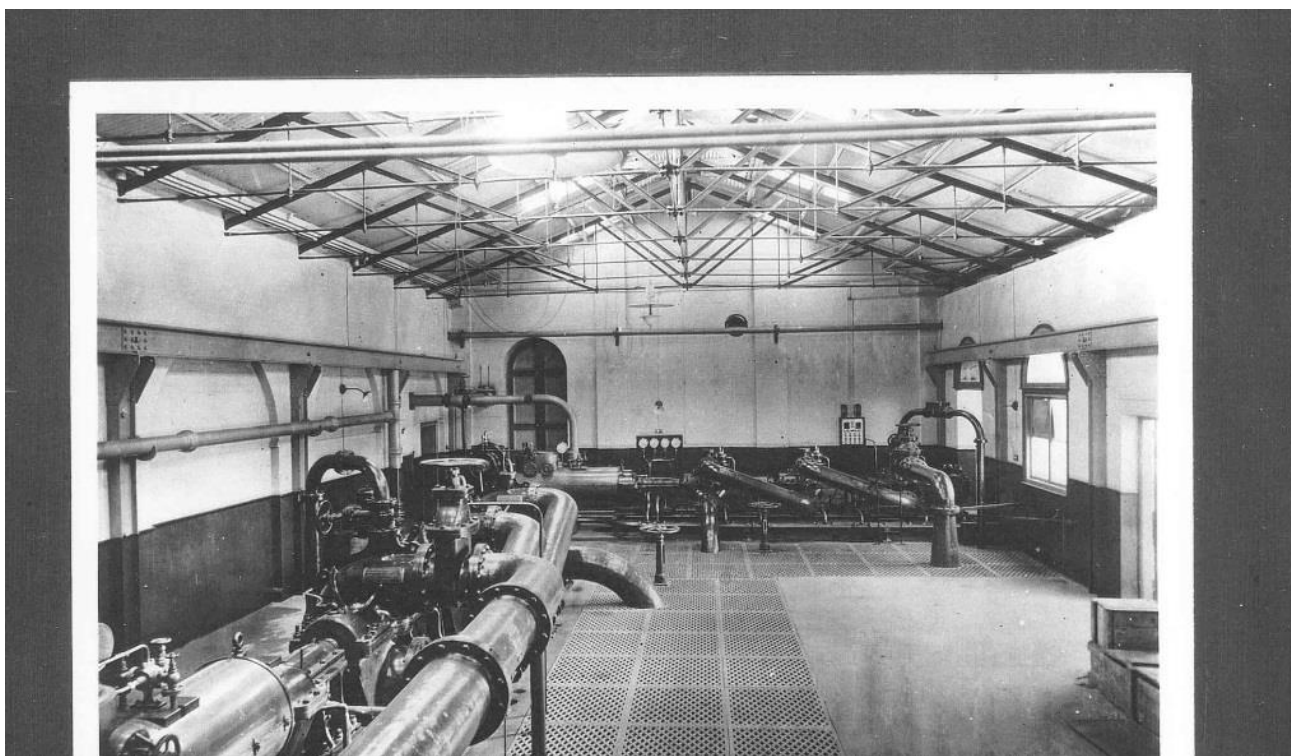
In 1917, the pumping plant was supplemented with the addition of a Williams & Robinson Steam Turbine with Morts Dock & Engineering Pump (No.4 Turbo). This last unit was the only unit to be re-used in Ryde Pumping Station No.2.



Illustrating Watt Vertical Pumping Engine installed in 1891 - Station No.1



Illustrating Allen engine and Crompton electric generator in 1916 -Station No.1



Illustrating Parsons turbo-centrifugal unit no. 1 installed in 1907 - Station No.1

The Reservoir (1890/1)

The reservoir at the *Ryde Water Pumping Station* was built in 1890-91 of cement rendered brick with sandstone capping. The circular reservoir is situated adjacent to Victoria Road at the northern end of the site. It is 140 feet (c.42m) in diameter and has a capacity of 2,000,000 gallons (over nine Megalitres).

The reservoir is semi-submerged within earth banks and is surrounded by a wire mesh fence. The incoming and outgoing pipes and valves associated with the reservoir have been relocated as the use of the site has been altered. Its original function was to serve as the suction supply buffer reservoir for the pumps.

In 1922, following the opening of Pumping Station No.2, the inside of the reservoir was scabbled back and re-rendered using a Cement Gun that spray the inside walls with cement render. After the closure of Pumping Station No.1 it served as a heat sink for cooling turbine and gear oil from Pumping Station No.2. Today, it functions as a surge relief tank for the incoming water.

The valves associated with its current use as a surge relief tank for Pumping Station No.2 are located in the bank east of the reservoir and in a submerged pit south east of the reservoir.

The reservoir initially received water by gravity via Potts Hill which also supplied Crown Street Reservoir. In 1903, the water was delivered from Pipe-head at Guildford also via gravity.



Illustrating the reservoir c1891



Illustrating the reservoir



Illustrating reservoir with roof. (2004).

Valve House

The valve house at the *Ryde Water Pumping Station* was built at the same time as the reservoir and is an octagonal brick building featuring decorative brick machicolations and a projecting cornice.



Illustrating the Valve House associated with the Reservoir – dates from 1893 (2008)

Engineers Residence (1892)

In the 1890s the *Ryde Water Pumping Station* was remote from the city and twenty-four hour operation accommodation had to be provided for the Engineer-in-Charge and for site workers. Consistent with Board policy, a residence was built on site for the resident engineer. The policy of providing accommodation for the resident engineer was maintained until the 1950s.

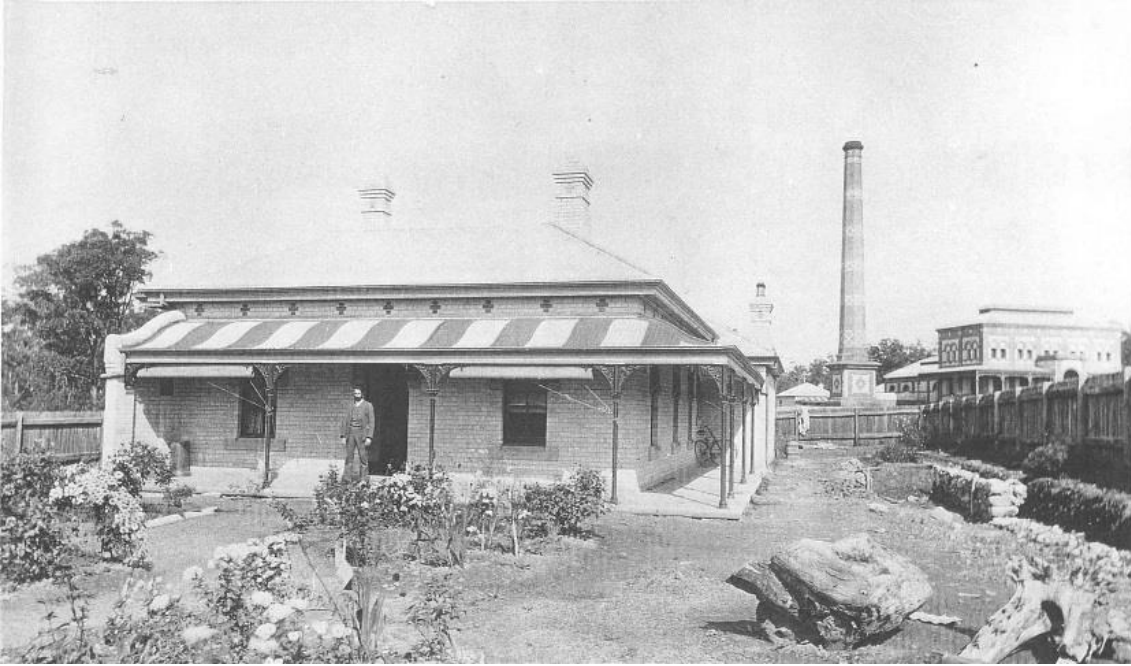
By 1892, a single storey brick cottage had been constructed for the site engineer and his family. It was completed shortly after the opening of Pumping Station No.1.

In 1907 it was necessary to enlarge the residence and a second storey was added to accommodate the engineer's growing family.

The two-storey residence demonstrates characteristics of both the late Victorian and later Federation period including verandahs features timber posts and fretwork. The walls are made of blond bricks with decorative arches above the windows. The front (north) elevation is symmetrical. On the upper level double hung French doors open onto the verandah. The original slate roofing has been replaced with terracotta tiles. At the rear of the house are two single storey wings with corrugated iron roofing.

In 1981, the engineer's house was vacated by the Board. The subdivision of a parcel of land comprising the engineer's residence and small front and rear garden was completed in 1983 and the residence sold to the Department of Housing. The public interest function of the house continued, with the Department of Housing using the house as temporary public accommodation and then leasing it to the Ryde- Hunters Hill Community Housing Cooperative in July 2004. It was sold again in 2012 to a private buyer.

The house is visible from and to the pumping station although being partially obscured by planting along the boundary fence.



Illustrating former Engineer's residence c1892, note station No. 1 in rear. House was originally a single story.



Illustrating former Engineer's residence – second storey added 1907. (2010).



Illustrating former Engineer's residence – second storey added 1907. (2004).

Workmen's Cottages

Accommodation at the *Ryde Water Pumping Station* was also required for subsidiary staff working in the pumping station. In 1900, the Board's Annual Report records the erection of four cottages for accommodation of Ryde's pumping staff. Completed in 1901, these were described as follows: *"the cottages ... prove a great convenience, especially during broken hours of pumping and work ... such as hurried repairs, etc., as the men lose no time in getting here."*

The location of the cottages is uncertain but as the Board owned land on the north side of Victoria Road opposite the pumping station and on the west of the railway line it is thought this could be the location of the houses. Four Board cottages do appear on a plan. Two cottages marked for 'firemen' and two marked for 'engineer' (Refer to figure 130, page 241, Doring 1991). These cottages have since been demolished.

Expansion of the Pumping Station Site

The suburban boom during the 1920s, part of a Sydney-wide phenomenon, increased demand for water and Pumping Station No.1 was expanded progressively.

The auxiliary plant (Allen engine) was built in 1916 to supplement the original pumping station but even at the time of opening in 1892 plans were underway for the construction of a second freestanding pumping station. The Board decided to purchase additional land from the original 100 acre grant adjacent to the existing station

In view of the ever increasing demand on Pumping Station No.1 the Board decided to consolidated the site and provide room for ancillary structures such as pipelines, coal storage and storage of waste (ash).

The Board acquired land sufficient to build Pumping Station No.2 in 1915. This was originally intended to operate in conjunction with Pumping Station No.1.

In 1920, the Board resumed Vickers Street amalgamating the site and establishing the configuration which exists today apart from the land containing the Engineers House.

Construction of Pumping Station No.2 was delayed by the World War II.

Ceasing Operation and Demolition of Pumping Station No.1

By 1930 Pumping Station No.2 could sufficiently supply the northern suburbs of Sydney on its own without needing Pumping Station No.1. Consequently, in 1930, after 40 years, Pumping Station No. 1 ceased operation. All equipment was sold or scrapped apart from the No.4 turbo set which was re-used at Pumping Station No. 2.

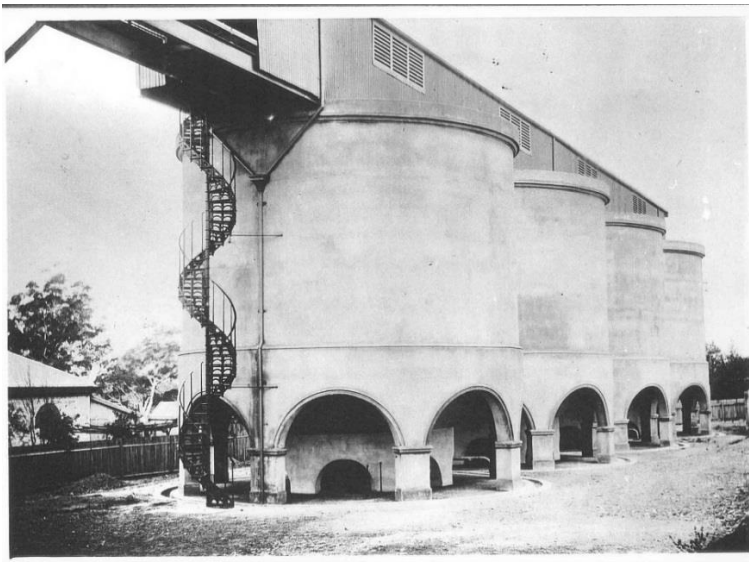
From the mid-1930s, Pumping Station No 1 was used as a store. Its tall brick chimney was demolished in the 1950s and the entire structure including the coal storage silos were demolished in 1961. The buildings were cut down to ground level and the basement filled and covered by a concrete slab.



Illustrating the Ryde site, clearing for Station No.2 c1915.



Illustrating Station No.1, coal silos, internal railway and the Manning Wardle steam loco. (c1930s)



Illustrating the coal silos associated with Station No. 1. (demolished)

RYDE WATER PUMPING STATION NO. 2.

Ryde Pumping Station No. 2 is a large and impressive structure that fronts Victoria Road in West Ryde. Construction began in 1916 and the station was completed in 1921. It was formerly commissioned on 15 September 1921 by the Minister for Public Works. It cost an estimate 500,000 pounds.

At the time, the capacity of the two stations combined was 20 million gallons a day.

By 1919, the engine house travelling crane was installed and was being used to lift in the turbines and pumps.

By 1920, the shell of the building was practically complete, half the coal bunkers installed and glazing, painting and joinery were well underway.

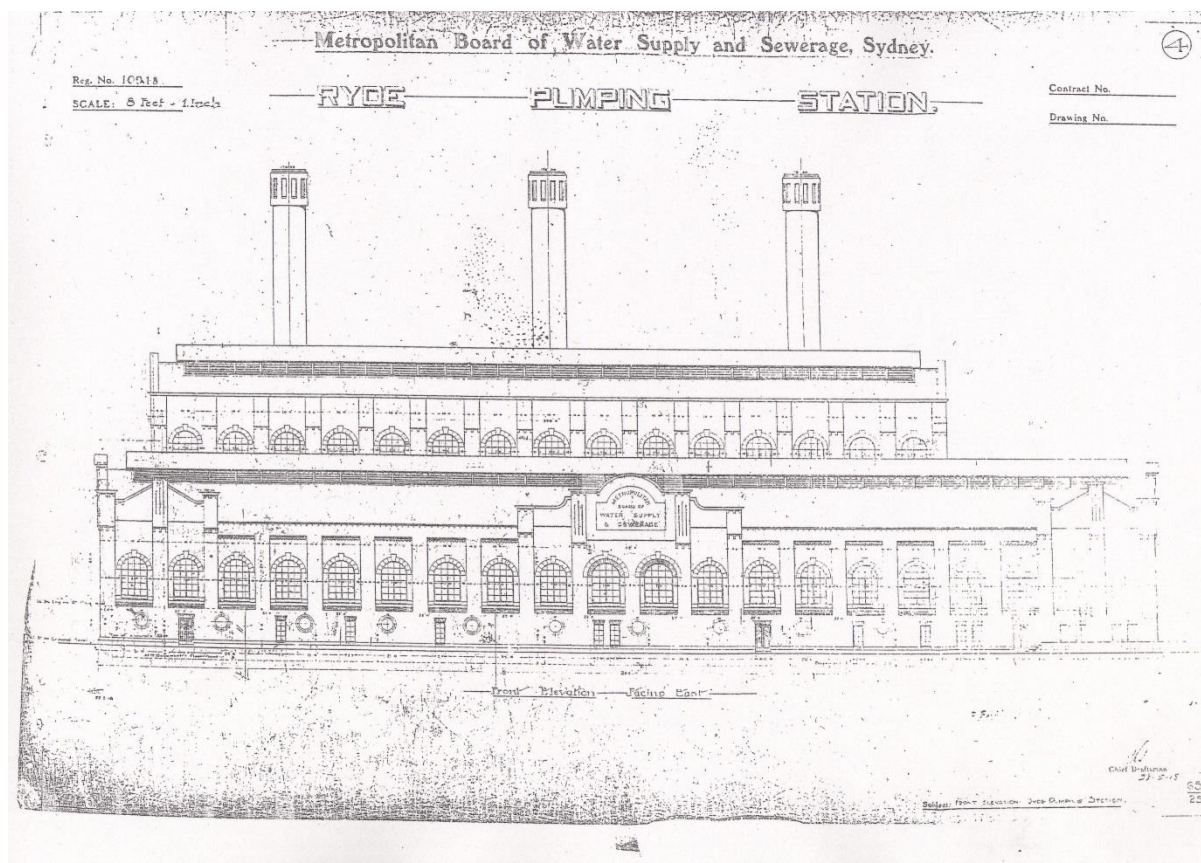
By 1921, the coal bunkers (hoppers), ash bin, and plate laying on the coal staithe were complete as well as new suction and delivery mains. Painting, glazing, lagging of steam pipes, electrical installation, fencing and some of the machinery for the pumps was progressing. The sanitary drainage and new septic tank, valve and Venturi meter chambers and site clean-up still had to be done.

The overall construction of the pumping station comprises a brick walled building containing over one million bricks. It was originally roofed with asbestos shingles supported by steel trusses. The building features a series of large arch headed steel framed windows along each side of the building. There are also square windows in the iron clad wall on the upper part (coal staithe) of the Boiler House. Some rendering of the brick façade occurs around the gable fronts and on the window sills.

A major changes to the fabric of the station was the reroofing of the station (Pump Hall, Boiler House and Economiser House) in sheet metal after removing the asbestos shingles. The original asbestos roofing was probably used for its fire retardant properties. The change from shingles to large continuous sheet metal is major change to the appearance (aesthetic values) of the station.

Ryde Water Pumping Station No. 2 was designed to minimise the manual handling of the coal. The coal was brought to the site by rail in coal wagons. These wagons were shunted by the onsite railway engine into the coal staithe where the coal was dumped directly from the wagons into hoppers and from there into the boilers below. This process eliminated manual handling and other forms of mechanical handling such as conveyor systems. The disposal of ash was the subject of a number of different disposal techniques.

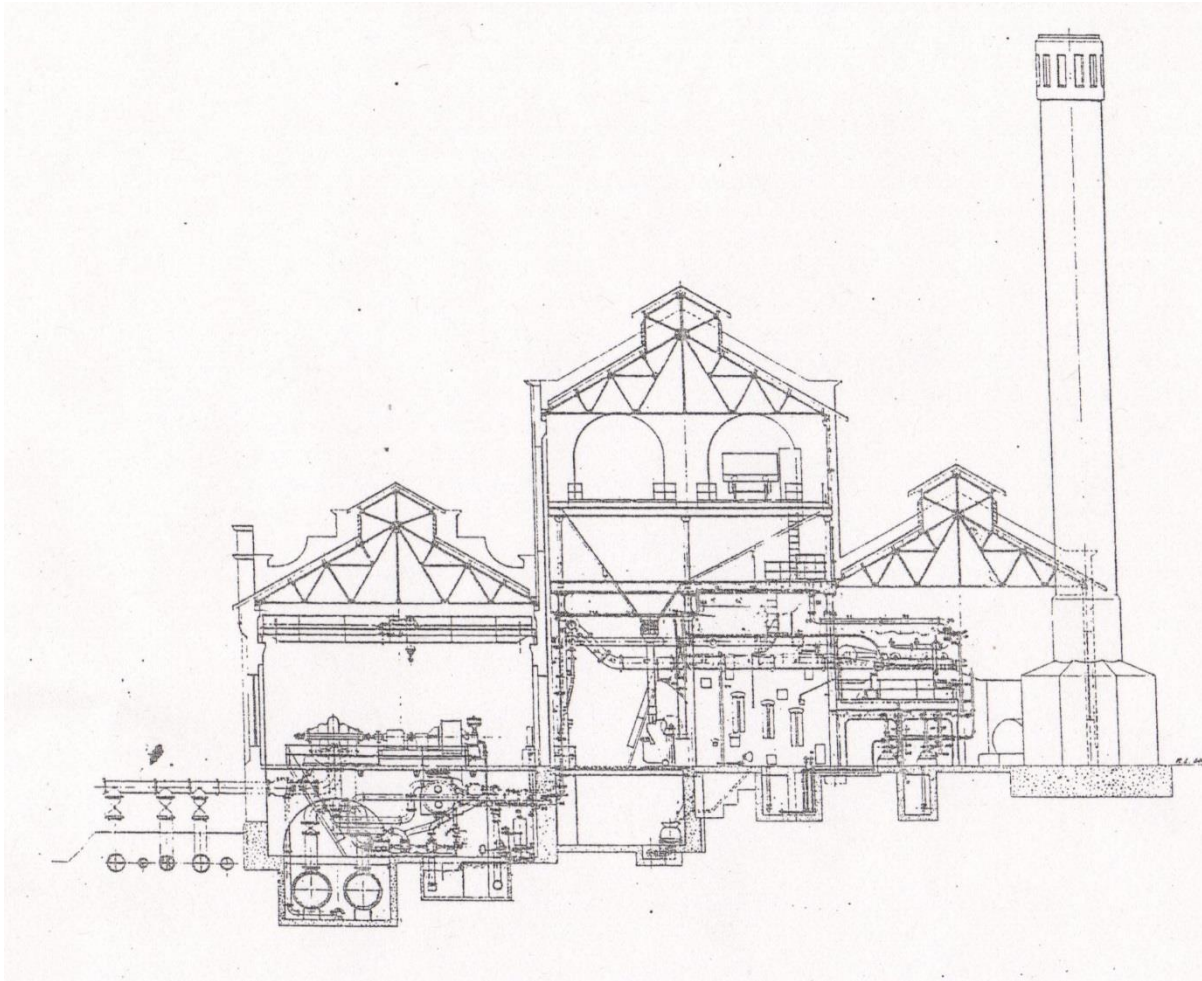
Pumping Station No.2 consists of an Engine or Pump House, an adjoining Boiler House, an Economiser House and an administration block.



Illustrating original elevation of Pumping Station No. 2.



Illustrating sections and elevations of Pumping Station No. 2.



Illustrating original section through Pumping Station No. 2. Shows rail carriage in coal staithe of Boiler House and full height chimney.



Illustrating Station No. 2 being built, note two chimneys but room for a third. (c1920)



Illustrating Station No. 2 being built, showing Pump Hall and administration area fronting Victoria Rd. (c1920).

Engine (Pump) House

Pumping Plant

Contracts had been let by November 1916 for the machinery and plant for Pumping Station No. 2.

The pumping plant in 1921 consisted four Williams-Robinson steam turbines (from England) and two Parsons steam turbo-alternators. Plus four Thompson & Co (Castlemaine, Victoria) centrifugal pumps made to the Board's design.

In 1922, local residents complained about the noise from the Chatswood pump and in 1929 two Frazer and Chalmers/Kelly & Lewis pumping units were commissioned to pump to the Hermitage Reservoir.

In 1926, a new 48inch suction main from Pipe Head to Ryde had been installed and was delivering water to the pumping station site.

In 1927, Pumping Station No.2 was amplified and contracts were let for the supply of two turbines for a direct connected to centrifugal pumps for the Hermitage supply. At this time, the engine house was extended (Mobbs Hill extension) for new pumps for the rising main to Mobbs Hill. The No 4 Turbo Unit from Pumping Station No. 1 was moved to Pumping Station No. 2.

In 1928, a new tunnel under the Parramatta River was completed and this replaced the section of suction main that was bridged over the river. Also in this year, pumping units 11 & 12 (Hermitage units) were installed. These were 842 bhp Frazer & Chalmers turbines with Kelly and Lewis pumps.

In 1929, unit No. 13 was installed into the Mobbs Hill extension and this unit was a Metropolitan Vickers turbine with a Thompson pump. This delivered to Mobbs Hill or Wahroonga in conjunction with the No. 4 Turbo unit that had been relocated for Pumping Station No.1. Also in this year, a new 10-ton overhead crane was installed.

The original machine shop which was located in the administration block was replaced by a new extension to the southern end of the Pump Hall onto the end of the Mobbs Hill extension. This extension was demolished in the 1970s and replaced with a new machine shop (the Annex) which remains today. It is easily identifiable as it is built in a different architectural style and scale to the original building.

In 1932, two Briton Thompson Houston electric pumping units were installed to pump water to Pymble reservoir and a single Williams and Robinson steam turbine connected to a Morts dock pump was dismantled from Pumping Station No.1 and installed in Pumping Station No.2. The Briton pumps were not a success and utilised immense power and failed number of tests. They remained as standby pumps for a number of years but were eventually taken out of service in 1953.

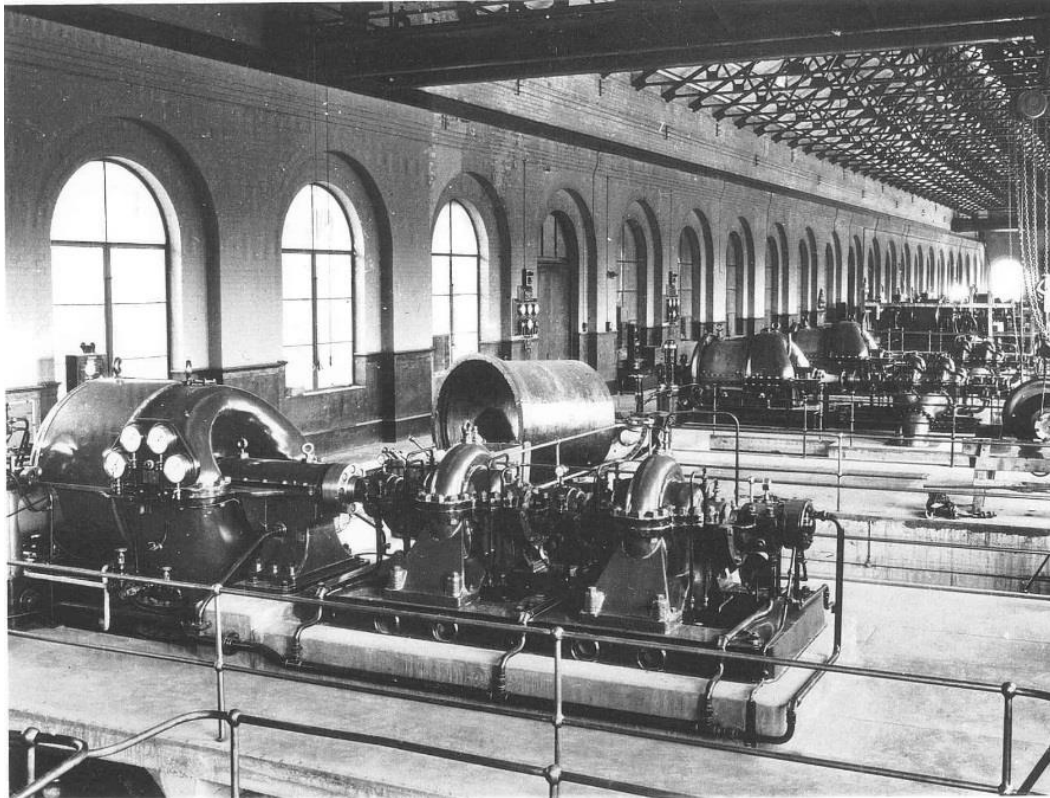
In 1938, contracts were let for five new steam turbines, pumping units and auxiliaries. These were the No. 9 pumping unit which was an 1800bhp Metropolitan Vickers turbine and Thompson 15-inch pump, and Nos. 10, 14, 15 & 16 pumping units and these were 750 bhp Metropolitan Vickers turbines with Thompson 12-inch pumps. These the first turbines with reduction gearing to be utilised at Ryde

In 1958-59, a new steam plant was installed comprising four Frazer and Chalmers turbines (General Electric) coupled to the Thompson pumps. These units replaced the Williams-Robinson/Thompson geared units Nos. 5, 6, 7 & 8 which were removed and probably scrapped. The new turbines remained in use until 1976. They had been removed by 1981 when the conversion to electricity was completed.

Prior to electric drive, the steam plant included 12 steam turbines with a total output power of more than 11,320 KW. The changeover to electricity was expected to double this output. Four pumps were successfully converted to electric power. These were the Thompson pumps connected to the 1958/9 Fraser & Chalmers engines, originally units 5 & 6 and 7 & 8.



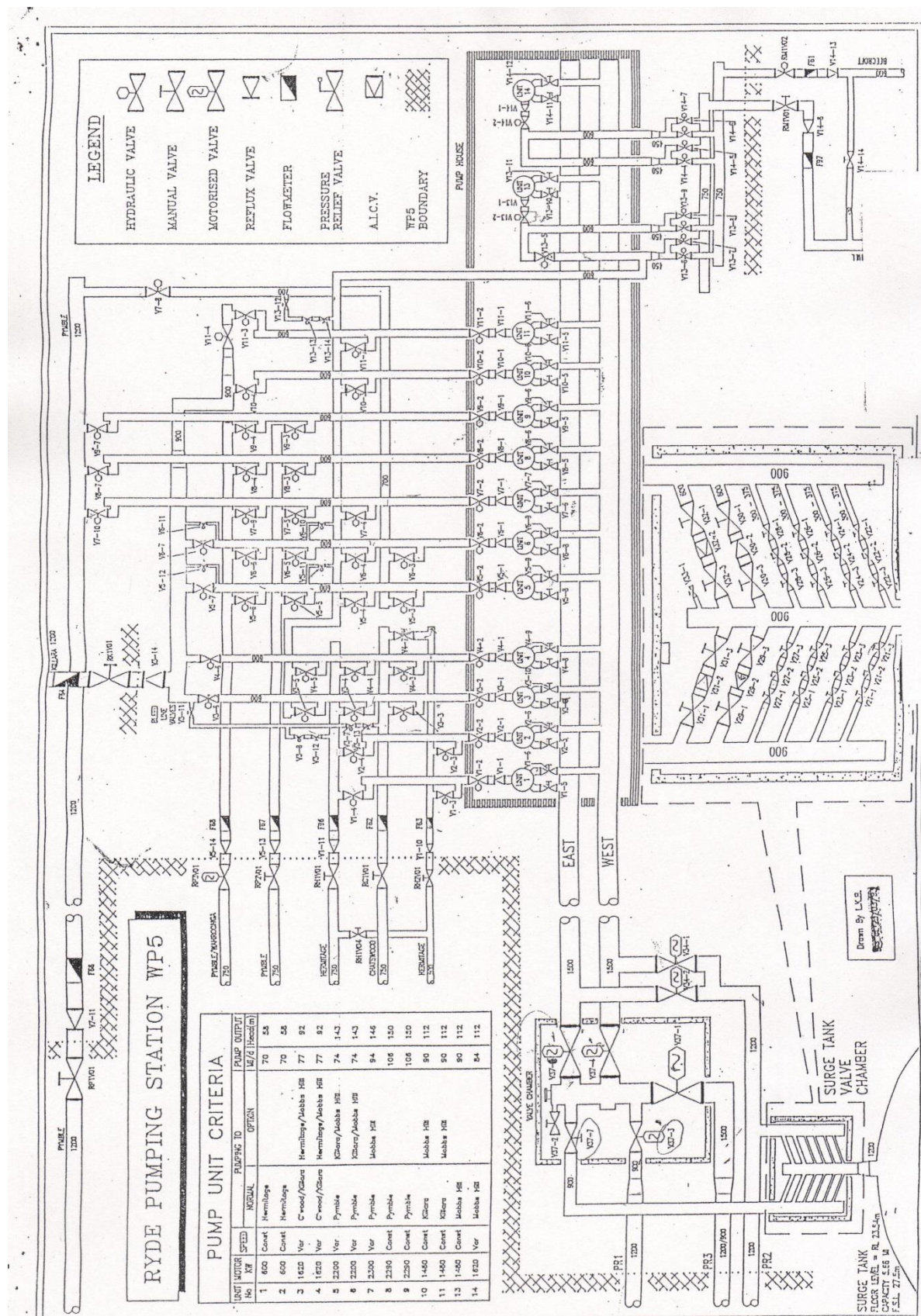
Illustrating Station No. 2 – the Pump Hall or turbine hall. Showing the original turbine pumps



Illustrating Station No. 2 – the Pump Hall or turbine hall. Showing the original turbine pumps



Illustrating Station No. 2 – the Pump Hall or turbine hall. Showing the original turbine pumps



Illustrating Station No. 2 – the Pump Hall layout. C?.



Illustrating Station No. 2 – the Pump Hall after electrification. c1982.



Illustrating pump equipment. (2004).



Illustrating Pump Station No 2 exterior of Pump Hall, including Mobbs Hill extension and part of the 1970s Annex (2008).

The Engine House (Pump Hall)

The Engine House or Pump Hall is a large single storey space with basement and is on the eastern side of the station. It has been added onto with the Annex extension in the 1970s. This extension does not match architecturally or in scale to the original part of the building. The Pump Hall has been modified over time originally housing steam driven turbines, today it houses modern electrically powered pumps. A ceiling was installed into the Pump Hall in the 1980s.

The Engine House continues to pump water to the northern regions of Sydney. The station was progressively converted to electricity from 1975 until 1981. Due to this change of power supply from coal to electricity, the Boiler and the Economiser Houses became redundant and today are unoccupied and unused.

On the eastern side of the Engine House are the majority of pipes and valves (manifolds) which date from the mid and late 20th century.



Illustrating Pump Station No 2 exterior of Engine House or Pump Hall (2008).



Illustrating Pump Station No 2, Mobbs Hill extension to left of parapet. (2008).



Illustrating Station No 2 control room overlooking Pump Hall (2002)



Illustrating Station No 2 control room overlooking Pump Hall (2002).

Boiler House

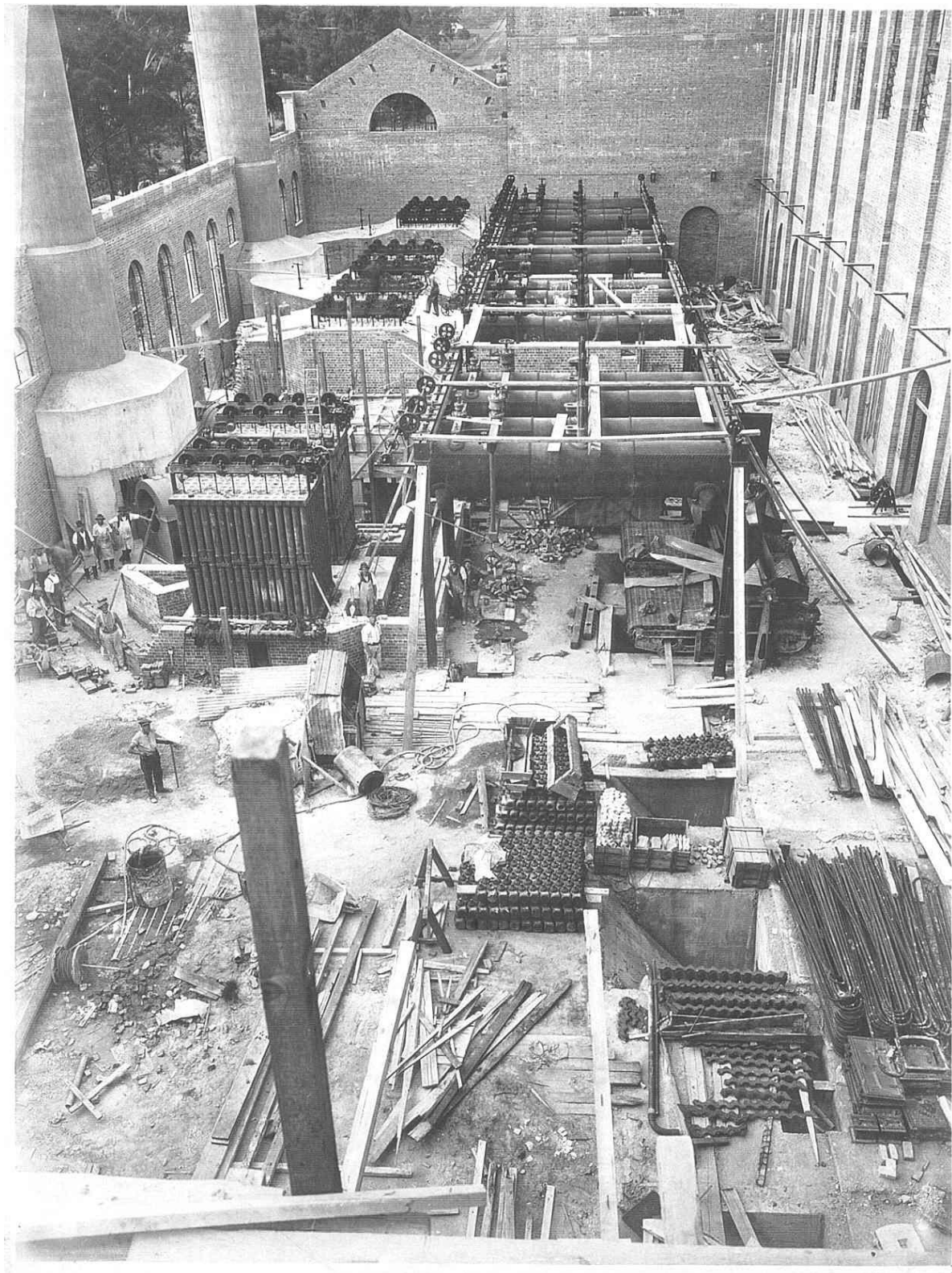
Boiler House of Pumping Station No.2 was under construction in 1917 and the Annual Report of that year stated:

'New pumping station in construction. Work here has made good progress with the limited amount of available money. All boiler foundations have been completed and the excavation for the rest of the substructure is well in hand, the rock being utilised in concrete work and spoil in the formation of the embankment for the coal siding. The contractors have commenced erecting the boilers. The turbines and pumps have been delivered for the Chatswood unit.'

Annual Report in 1918:

'At Ryde, the new portion of the Pumping Station is laid out for powerful machinery to maintain the supply to the northern suburbs. The first set of boilers and economisers is finished, and the second set advanced as far as landed materials would allow. The Board is, however, experiencing much difficulty in the progress of these extensive works, by the non-arrival of machinery from overseas.'

This delay of delivering machinery would have been due to the war in Europe, WWI.



Illustrating Station No. 2 being built, showing the interior of the Economiser and Boiler Houses. Note the economisers and boilers being installed during the construction.



Illustrating Station No. 2 – interior of the Boiler House, showing the concrete hoppers and original boilers. (1956).



Illustrating Station No. 2 – interior of the Boiler House, showing the concrete hoppers and original boilers. (1956)



Illustrating Station No. 2 – interior of the Boiler and Economiser Houses following conservation works. (2014)

Steam Plant

The original steam plant installed into Pumping Station No.2 included eight Babcock and Wilcox steam boilers set in four batteries of two, eight superheaters, eight Babcock and Wilcox chain grate stokers and eight Green's 160 tube economisers.

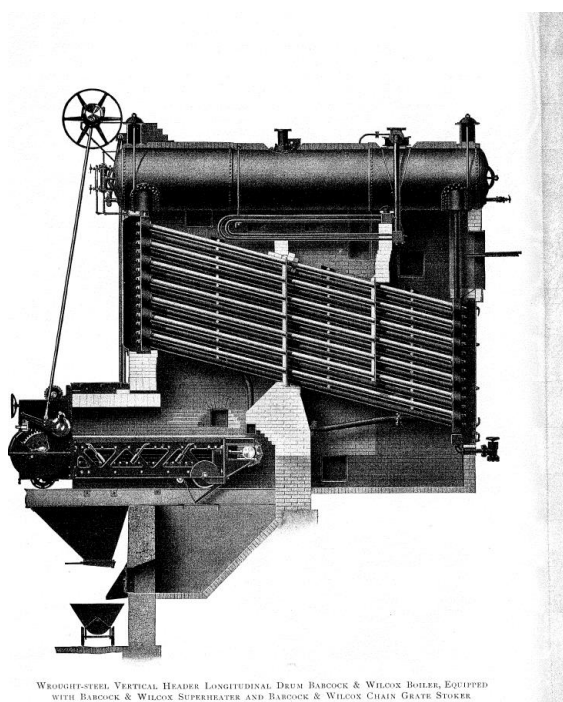
The Babcock & Wilcox steam boilers each had evaporative capacity of 12,300 lbs/hr.

The steam plant also included four Sirocco/Ferrier and Dickinson draft fans, a Webster feed water heater and two Worthington feed water pumps with Terry turbines.

In 1930, when Pumping Station No.1 was closed down a new Kidwell four-drum boiler (No.9), a high-pressure boiler, was installed to provide steam for the Mobbs Hill pumping units. The third chimney stack was built for this boiler. This chimney was slightly larger than the first two.

In 1938, two new Babcock and Wilcox boilers were ordered to accompany the five new steam turbine pumping units being installed into the engine house

During 1958-59, two International Combustion boilers (units Nos.12 & 13) were installed. These were large boilers which could raise 50,000 lbs of steam per hour and replaced the four original Babcock and Wilcox boilers (Nos. 5, 6, 7 & 8) which were removed and scrapped.



Illustrating a Babcock and Wilcox Boiler – with chain grate stoker

Electrification

In 1972, the Board decided to convert Pumping Station No.2 to electric drive with the first units converted in 1975. The proposal was for an installation of a mixture of fixed speed and variable speed electric motors allowing variable combinations or variable speed alone so as to match the required water delivery at any time.

The existing pumps of units 5, 6, 7, & 8 were retained but their turbines were replaced by more powerful electric motors. This allowed for the later installation of larger capacity pumps.

Electric power was supplied from the Meadowbank 11,000 volt 3-phase supply via a dual metering system direct to the pump motors at 11kv.

In 1976, Pumping Station No.2 had five steam boilers units in operation and 12 steam turbine pumping units in operation. Coal consumption at the time was about 120 tonnes a day (about three wagon loads).

In 1980, it was recorded in the Annual Report that eight of the 13 units involved in the conversion had been installed.

In March 1981, the stream was turned off. A ceremony was held to commemorate the event and main control valve to turbine No. 8, installed in 1957, was closed by Roger Cody former Engineer-in-Charge. The conversion had cost about \$13 million.

Notably in May of 1981, it was proposed by Mr N Thorpe (to the local Ryde Historical Society) to establish a Water Board Museum in the Boiler House.



Illustrating Station No. 2 – interior of the Pump Hall, conversion to electricity. (1975).



Illustrating Station No. 2 – interior of the Pump Hall, conversion to electricity. (1975).

The Boiler House (building)

The Boiler House occupies the central section of the Pumping Station No. 2 and is higher than the flanking Engine and Economiser Houses. The rail viaduct leads into the upper level of the Boiler House. This area, known as the coal staithe, contains two railway lines that run over the reinforced concrete hoppers. This formation allows coal to be delivered directly from the wagons into the hoppers below and meets the definition of a 'coal staithe'. A coal staithe is primarily used at a wharf or dock when delivering coal directly into a ship's hold.

The coal hoppers and two rail tracks are supported by a large riveted steel frame. Strong enough to support the reinforced concrete hoppers plus the fully laden coal wagons makes this an integral part of the station. The steel frame was originally free standing and independent of the brick walls allowing for the movement created by the engines and wagons entering and exiting the staithe. This structure was completed c1920 and is similar in design and technology to the later Sydney Harbour bridge.

It was proposed in 1972, when the Board decided to convert the station to electric supply to retain the Boiler House but to remove the chimneys, hoppers, boilers and all other redundant equipment.

During the conservation works to the building in 2005-2007, it was required that the building be strengthened for earthquake and the steel structure was engaged with the surrounding brickwork of the Boiler House. This change prevents fully laden coal wagons being shunted into the building making the function of the coal staithe obsolete. There is however, no obvious visual change to the space.

Today, the Boiler House contains the coal hoppers and the coal staithe with railway tracks. The coal staithe is largely intact and is the most easily interpretable part of the Boiler House. All the boilers and the coal burning equipment have been removed. The original concrete floor remains. In this floor there is evidence of rails for the coal feed conveyors at the mouth of the boilers plus large openings showing where the boilers and other equipment has been removed.

Numerous other elements such as elevated metal walkways, metal ladders, hooks, pipework and smaller elements from the steam era remain in the Boiler House.



Illustrating Station No. 2 from opposite side of Victoria Road, note Station No.1 chimney also evident. (1956).

Economiser House

The original equipment to be used in the Economiser House were the eight Green's economisers.

The Economiser House is located on the western side of the station and the three chimneys are located along its western elevation. Although there is no separating wall between the lower level of the Boiler House and the Economiser House the roof over the Economiser House is distinct and separate to that over the Boiler House. Like the roofs over the pump and Boiler Houses it has a clerestory lantern with ventilating louvers and is supported by steel trusses. There is no ceiling in the Economiser House.

The Economiser House's exterior is largely unchanged other than the introduction two new openings to the exterior (chimney) wall and the installation of two large roller doors. These were created in 1958-60 to open up the building to allow the removal of the four original Babcock and Wilcox boilers that were replaced with the two large International Combustion boilers.

Today, the Economiser House has lost all of its equipment. The interior of the Economiser House retains the bases of the original reinforced concrete chimneys. The original concrete floor remains although it has been modified over time. In this floor there is evidence of the equipment with openings showing where the economisers and other associated equipment was originally situated.



Illustrating Pumping Station No. 2 – the restored Economiser and Boiler Houses (2008)



Illustrating Pumping Station No. 2 – the restored Economiser and Boiler Houses (2008)

Administration Block

The administration block is located at the front of the building complex facing Victoria Road. It is roofed with a low pitched sheet metal skillion surrounded by a rendered parapet. On this parapet an inscription of 1919 is shown but the building did not open until 1921. The architectural detailing in the administration building matches that of the rest of the station. Matching brickwork, steel framed windows and render unifies this part of the station with the other components. Wrought iron security grills were added to the windows in 1999 following the 9/11 attacks in America. There is a wide verandah facing Victoria Road with arched openings. Internally, the rooms are currently being used to house the Sydney Water and Water NSW's Historic Research Archives, offices and staff amenities.

In general, the roof scape is the dominant feature of the building with large expanses of roofing, roof lanterns, ventilating louvers and gable parapets. The roof was originally clad with asbestos tiles laid in an *Eternit* (diamond) pattern. The asbestos roofing was removed from the engine house in the 1980s and removed from the boiler and economiser houses in 2006. The roof over the engine house was re-clad in sheet metal (KlipLock) and this was also used in 2006 when reroofing the boiler and economiser houses.



Illustrating Pumping Station No. 2 – Administration - Victoria Rd elevation (2008)

Railway Viaduct

The rail viaduct is located at the south end of the Boiler House and connects the rail embankment to the building. This allowed the coal wagons to be shunted into the upper most level of the station. The viaduct consists of reinforced concrete 'T' beams spanning 40 feet between pairs of concrete piers. The piers are approximately 10 metres high and are supported on large brick/concrete bases. The beams and the support piers have been constructed with no movement joints. The girders within the beams are tied back into the building structure at the north end and into the brick rail embankment at the south end. Steel railway tracks are laid on top of timber sleepers which span across the concrete T girders. The timber sleepers were replaced in 2007 and are secured in place by bolting through the top flange of the T girders and are in good condition.



Illustrating Station No. 2 – the rail viaduct leading into the coal staithe inside the Boiler House. The 50 horse power oil locomotive shunting the coal wagons. (c1921).



Illustrating Station No. 2 – Diesel 'Planet' locomotive shunting coal wagons on the rail viaduct into the Boiler House. Note the three full height chimneys, Economiser House and upper level of Boiler House (coal staithe). (1975).



Illustrating the conserved rail viaduct leading to the Boiler House. (2008).



Illustrating Station No. 2 – the rail viaduct leading into the coal staithe inside the Boiler House. (2008).

Coal Staithe

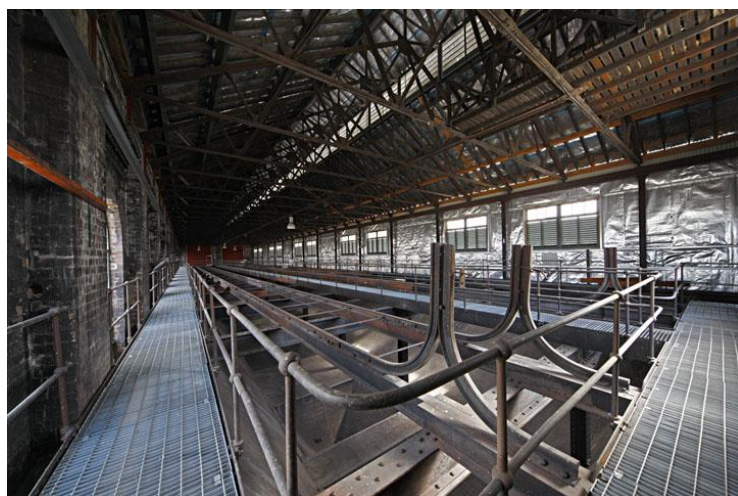
An upper level of the Boiler House, also referred to as the coal staithe, was built with the two rail tracks crossing over the reinforced concrete hoppers below. This design allows the coal to be dropped directly from the wagons into the hoppers. The reinforced concrete staithe and the external rail viaduct leading to the staithe were completed in 1919.

The coal staithe was considered an innovative feature at the time as was the reinforced concrete rail viaduct both of which allowed the direct delivery of coal to the hoppers and subsequently into the boilers below. No other pumping station is known to replicate this design.

In 1975, the consumption of coal at the station was recorded as about 45,000 tonnes a year and about 120 tonnes a day (about three wagon loads). There was an emergency stockpile on the site of today's upper car park of about 4,300 tonnes.



Illustrating Station No. 2 – on the coal staithe (upper level of Boiler House). Unloading coal into the hopper below. (1975).



Illustrating Station No. 2 – recently conserved coal staithe level (2008).

Chimneys

The two northernmost reinforced concrete chimneys on Pumping Station No. 2 were completed in 1918 and the third chimney was added in 1930. They are early examples of chimneys constructed from reinforced concrete. All three chimneys were truncated due to 'concrete cancer'. At the time, the mid 1980s, the National Trust of Australia (NSW) was lobbied by local residents to try and save the chimneys. They were considered a cultural landmark in the area and when dominant in the landscape driving along Victoria Road. Sections of these early reinforced chimneys were salvaged and retained on site for heritage interpretive purposes.



Illustrating Station No. 2 chimney, rail viaduct and rail siding. (1953).



Illustrating Station No. 2 chimney. Note Station No. 1 chimney and silos. (1953).

Chimney Remnants

There are three fragments from the former chimney stacks of the Pumping Station No.2 located on the western edge of the upper car park that now occupies the site of former Pumping Station No.1. The chimney remnants are semi-circular sections showing reinforcing rods at their broken ends and there is evidence of some decorative recesses on one of the sections.



Illustrating salvaged chimney remnants (2008).

MACHINERY AND OPERATION

A full chronological history (1891-1991) prepared by C & MJ Doring Pty Ltd of both the pumping and steam plant utilised at Pumping Station No.2 is attached.

The plant is also described in the Commemorative Booklet distributed for the Opening Ceremony of the '*New Water Pumping Station at Ryde*' (September 1921).

Railway Siding and Locomotives

The siding arrangements at the Pumping Station No.1 and for Pumping Station No. 2 were considered to be '*a rare Australian example of a siding without external function, shunted by the owners own locomotive*'.

The railway siding was built at the start of construction of Pumping Station No. 1. Coal was delivered in New South Wales Government Railways trucks, transferred to a hopper next to the pumping station and taken by a conveyor to a gravity elevator to nine elevated storage bins. In 1915 the station was supplemented by a 5-ton crane.

A significant feature of Pumping Station No.2 was the construction of the reinforced concrete viaduct connecting to the railway embankment to Boiler House and coal staithe. The viaduct was built by State Monier works in 1919. The railway embankment was partially constructed from excavated material from Pumping Station No.2 and ash waste from Pumping Station No.1.

Coal was delivered to the siding for Pumping Station No.2 by New South Wales Government Railways (NSWGR) locomotives. From here the Board's own locomotive shunted the rail carriages onto the viaduct and into the staithe. A weighbridge was installed in 1930 after a discrepancy in weights arose between the coal supplier and the Board.

Five different locomotives were used at the *Ryde Water Pumping Station*.

The first was a 50 horsepower oil loco. This appears in the 'opening' ceremony photos of 1921.

In 1923, the second and best known was the Manning Wardle steam loco, 0-4-0 saddle tank. It had previously been used from 1911 at Potts Hill No.2 Reservoir. It was taken out of service in 1960.

The third was the four cylinder petrol engine built by Purcell Engineering Co. Ltd. Auburn in 1931. It was first used in the construction of the Nepean Dam.

In 1959, the fourth locomotive was a Hibberd 'Planet' diesel locomotive No. 51, brought from the Warragamba Dam construction site and used at Warragamba from 1952.

In 1959, the fifth and the second identical Hibberd 'Planet' diesel locomotive No. 52 was brought to the site. The two 'Planets' were sold in 1981.

The Manning Wardle steam loco is now held at the Powerhouse museum, and was described as '*a real-eye catcher, old Number Four ... people would stop and stare as she panted her way up the siding to the bunkers. You could hear her woof-woofing sound for miles around*'.

The Board's purchase and use of their own locomotive for service at Ryde Water Pumping Stations is indicative of the focus on the station's independence retaining both stores of coal and the means to transport coal on site.



Illustrating one of the Hibberd 'Planet' diesel locomotives stored at Cowra Lachlan Valley Railway Museum, originally used at Warragamba Dam in 1950s and then used at Ryde from 1959 until 1981. (2014)

Ancillary Buildings

A number of ancillary buildings were constructed to support the work of Pumping Station No.2. Significant remaining structures include an efficiency engineer's office and amenities building, workshop, paint / brass shop and locomotive shed.

Efficiency Engineers Office & Amenities Building c1934

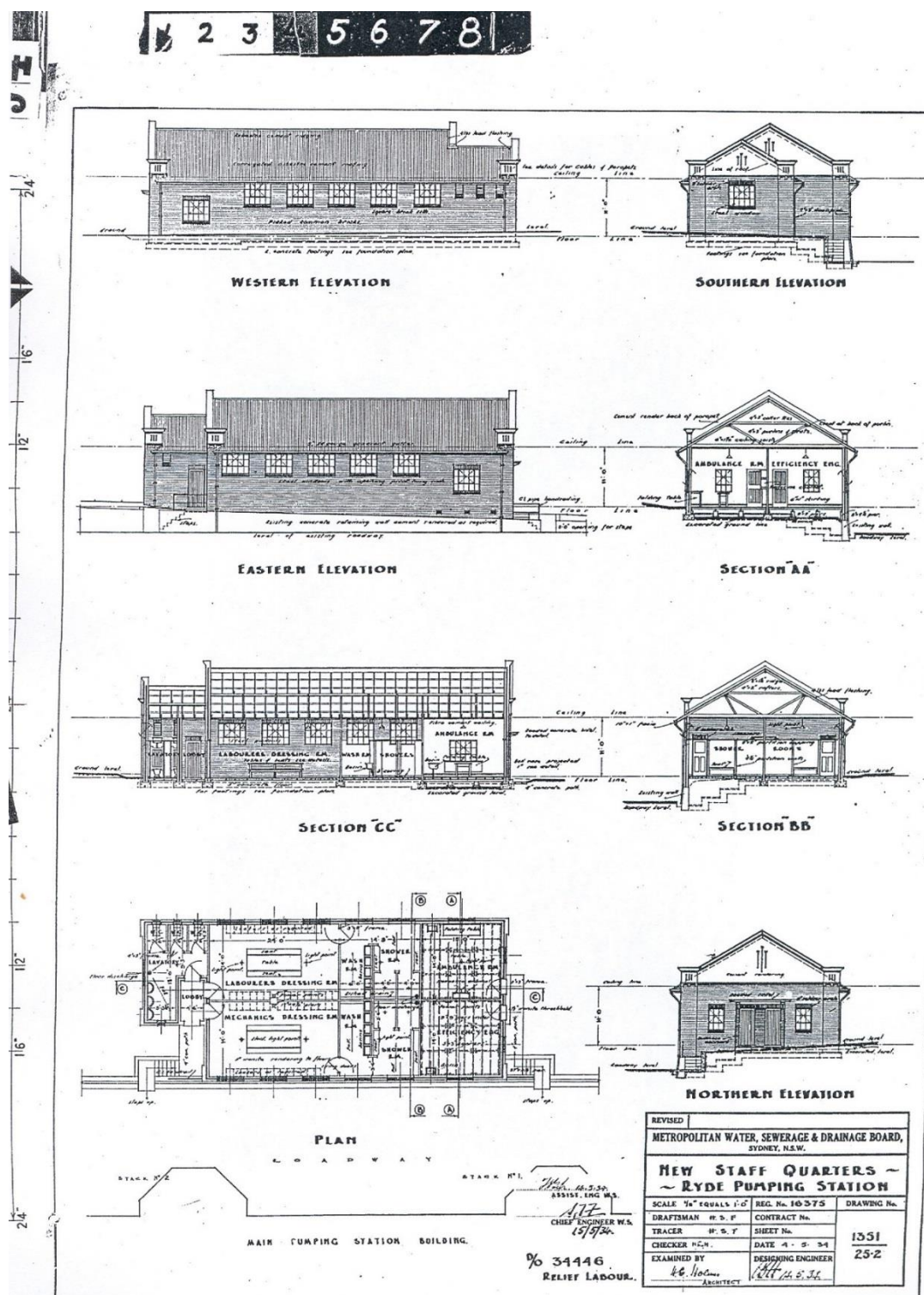
The efficiency engineer's office and amenities building was built on the west side of Pumping Station No.2. It contained an office, first aid room and staff amenities including showers, change rooms and toilets. No women's facilities existed on the site until the early 1980s.

Whilst the exact date of construction is unknown, the building shares similar characteristics to Pumping Station No.2. In 1934, the Annual Report noted that Depression Relief Funds were used to commence construction of 'Staff Quarters'.

Apart from the cultural plantings carried out during the Depression era this building is the only structure associated with relief works at the site. The function of the efficiency engineer was to keep records of the amount of water pumped by each unit, the steam raised by the

boilers and coal used enabling revisions or alterations to be made to keep the plant operating efficiently.

Colin Potter, former employee at Water Pumping Station No. 2, advises that this building was used as a change room and first aid room. Whilst there was no medical officer on site there would have been staff responsible for first aid and misuse of first aid ice from the refrigerator earmarked for burns treatment guaranteed instant dismissal.



Illustrating Staff Quarters and Efficiency Engineers office (1934).



Illustrating Efficiency Engineers office (2004).



Illustrating Efficiency Engineers office (2008).

Workshop Buildings

Ryde Water Pumping Station No.2 has had three workshops associated with the *Ryde Water Pumping Station*. The first was a room on the east side of the administration block next to the engine house. This room was converted to a switch room in about 1930 and a separate workshop constructed as an addition to the south end of the engine house.

The second workshop was connected to the engine house by roller shutter door and was replaced by the existing 'Annex' in the mid-1970s at the time of conversion to electric power. The southern wall of Pumping Station No.2 was removed when this workshop was constructed to enable the travelling crane to be extended into the new building and to enable repairs to pumps and motors.

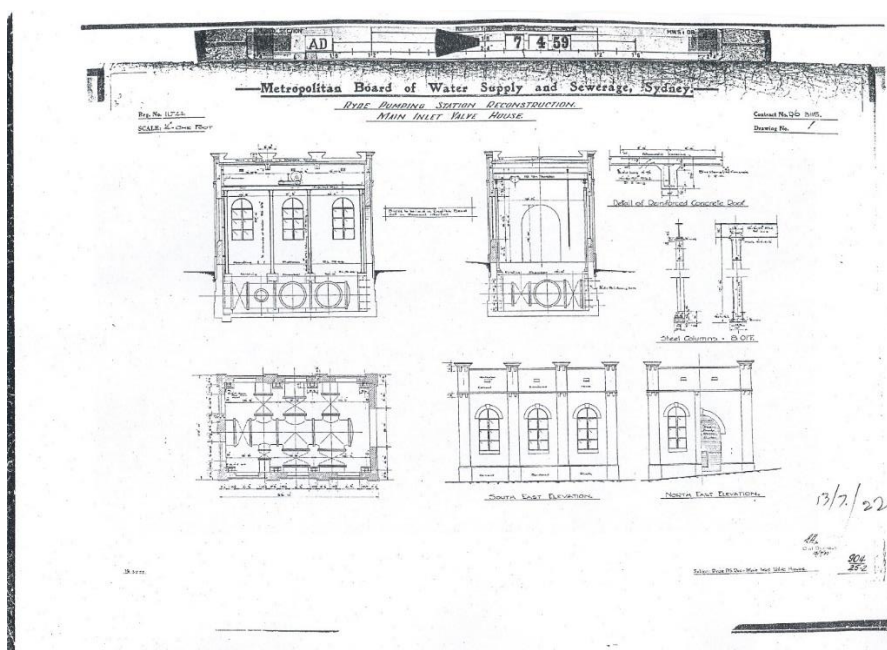


Illustrating the 'Annex' workshop (2008).

Inlet Valve House, later the Paint Store / Brass Store (c1922)

The Inlet Valve House was constructed c1922 but was adapted into the Paint Store and then the Brass Store. It is currently un-used. In 2004, the building was used as a store for brass type fittings and retained many old gauges and brass fittings but following the restoration and conservation of the building in 2006-7 it remains empty. It is a small brick building with engaged piers at each corner and piers between the arched headed openings. There is a former large opening on the west side which has been bricked up but retains a single door entry. A steel beam projecting out above the doorway indicates a former hoist. A pair of arch headed windows in the south wall have been bricked in, but a pair of steel framed windows in the north wall matching those of the Pumping Station No. 2 remain. The brickwork is in Flemish bond with alternating headers and stretchers.

Colin Potter, former employee advised that the Paint Store (Brass Store) was used as an oil store (for the steam engines) during the steam period, at least during the 1960s -1970s and the crane was used to lift the 44-gallon drums of oil.



Illustrating the original inlet valve house. (1922)



Illustrating the original inlet valve house. Later referred to as the paint store or brass store, before conservation works. (2004).

Timber Store

The small structure located to the west of the brass store is a former workshop or timber store. This building utilises to the retaining walls of the Boiler House on two sides. It had a shallow skillion metal clad roof. The roof was removed following extensive termite damage to the roof frame and is currently un-used and remains unroofed.



Illustrating the timber store (2004).

Locomotive Shed

The locomotive shed is a small steel framed building constructed to house the locomotive(s) used to haul the coal wagons on the site.

The exact date of construction is not known however it appears in an early 1921 photograph. This structure is considered likely to be associated with the shunting equipment necessary to deliver coal to Pumping Station No.2 rather than Pumping Station No.1.

Interestingly, old rail track has been used as structural members inside the building.



Illustrating Locomotive Shed (2008).



Illustrating Locomotive Shed (2008).

Ash Sluicing Plant

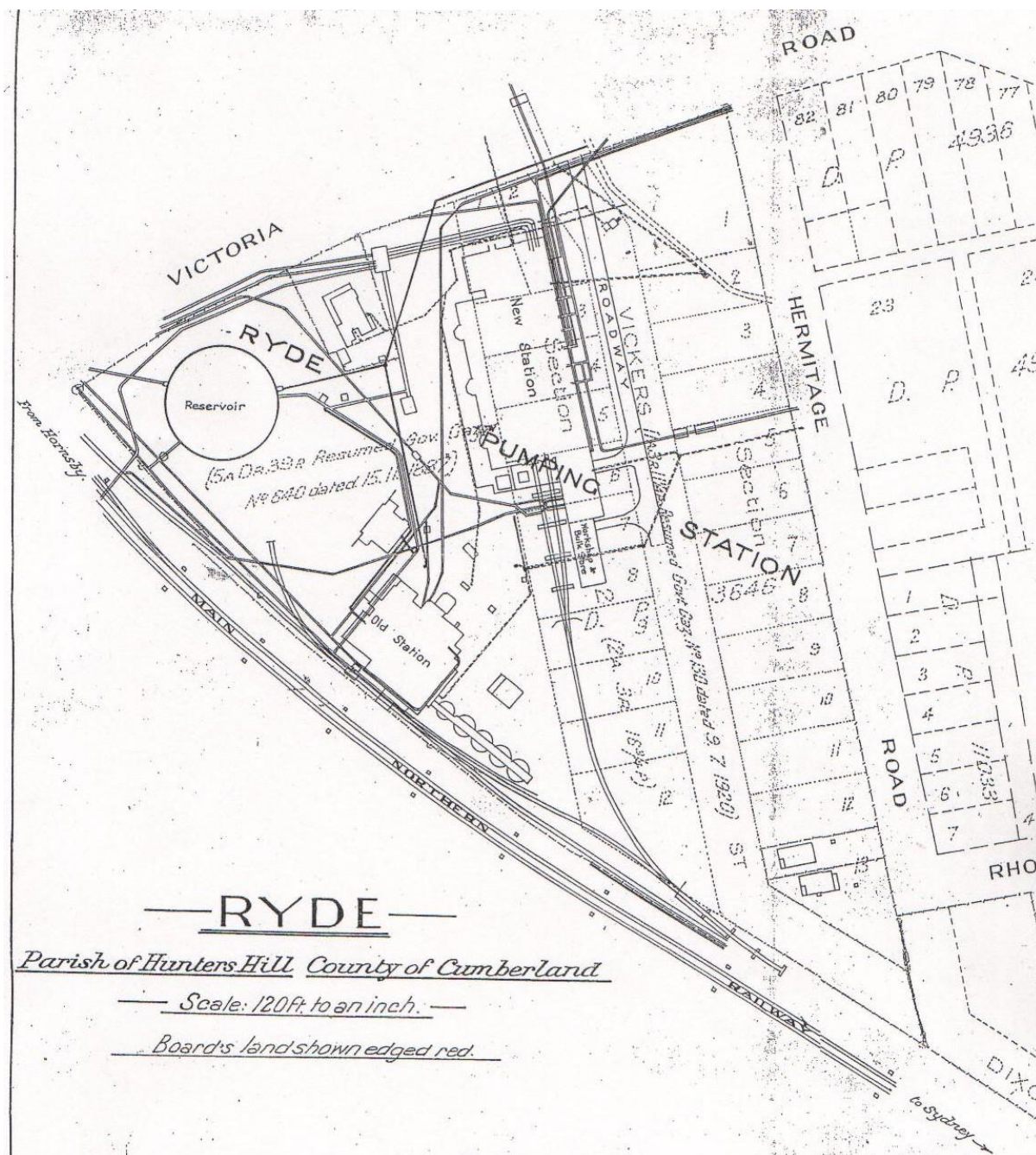
Management of ash on the *Ryde Water Pumping Station* was always problematic. Prior to 1957, the ash was manually removed from small hoppers located under the rear of the stokers / boilers in the ash tunnel floor. It was then loaded onto a truck, removed by a contractor and disposed of. Some of the material was used in local building. Much of the ash was also disposed of around the Ryde site.

The installation of the ash sluicing plant in 1957 superseded this system. It operated as a hydraulic system with ash and soot from the boilers dropping into running water which was washed into a trench. The trench ran the length of the ash tunnel under the engine room and into a pit located in the station yard east of the engine room.

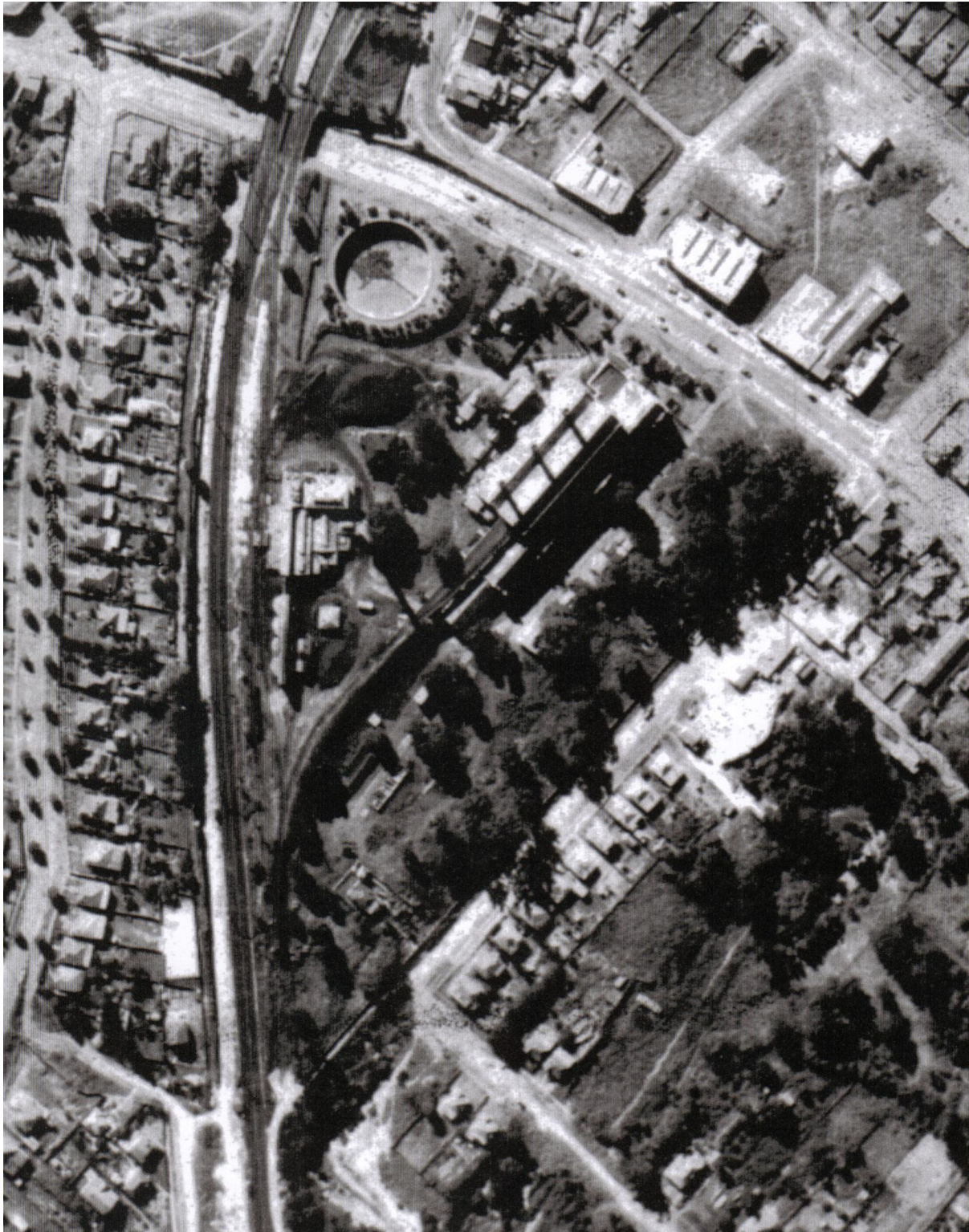
Ash was collected into the ash pit and was then transferred to a drying stack and finally disposed by truck. The water was filtered and re-used. The ash plant was demolished in 1991.



Illustrating the ash trench (shute) leading into the ash pit



Plan of the site, showing both Pumping Stations No 1 (old station) and No 2 (new station).



Aerial photograph of the *Ryde Water Pumping Station*, showing both Pumping Stations No1 and No2, the coal silos, the reservoir (unroofed), the Engineer's residence and the rail embankment. It shows the Victoria Road railway underpass built in 1937. (c1950)



Aerial photograph of the *Ryde Water Pumping Station*, showing Pumping Station No2, the reservoir (roofed), the former Engineer's residence and new sheet metal roof on the Boiler and Economiser Houses plus the solar panels on the Economiser House roof. (2016)

Depression Relief Works

During the Great Depression when large construction projects were curtailed and retrenchments common, the Government began in 1930 to initiate unemployment relief works. In 1931, the Board introduced work rationing where employees worked four days out of five and were paid accordingly. All employees, regardless of rank were on this scheme.

Recorded relief works at *Ryde Water Pumping Station* include the construction of garden, lawns and a concrete access road in the area fronting Ryde Station (Victoria Road). It is supposed that the group of palm trees situated along Victoria Road in front of Pumping Station No.2 are remnants of this work.

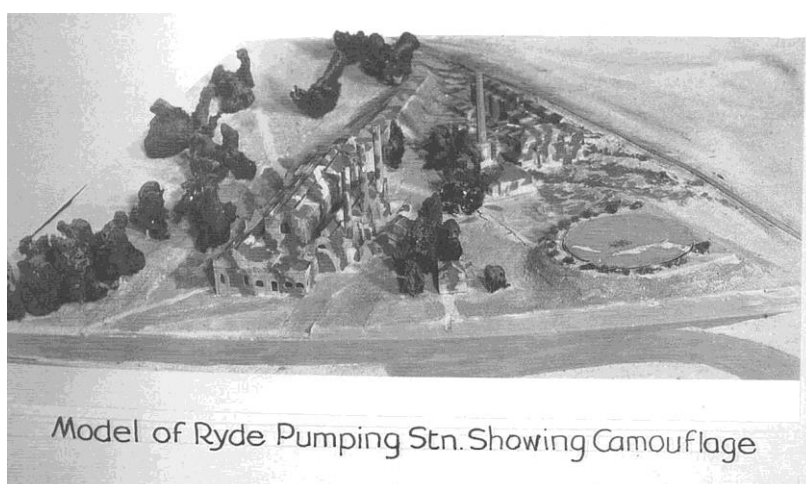
The Board was criticised during this period for simultaneously laying off workers and introducing inadequate relief works. Board staff, including professional men, engineers and clerks undertook pick and shovel work.



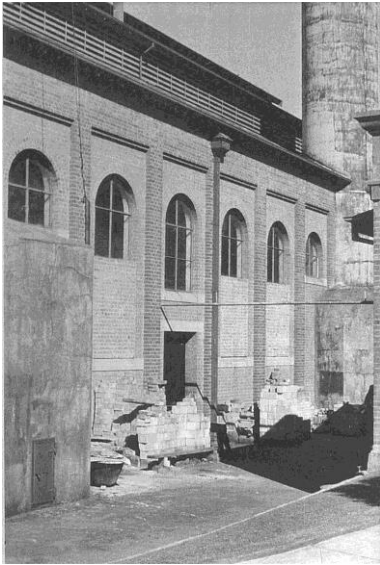
Illustrating the palms and concrete access road that was constructed by Relief Works in 1930s (2008)

WWII – defensive preparations

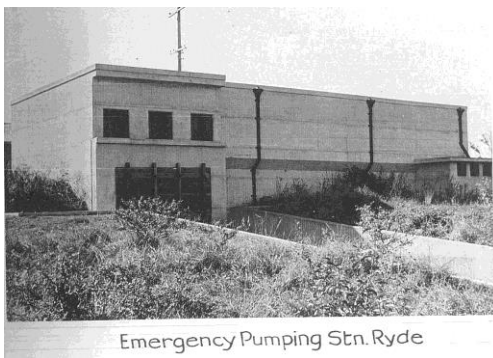
In 1942, Ryde Water Pumping Station No. 2 was identified as essential infrastructure and it became a focus of defensive activities in preparation of foreign invasion during World War II. The Board's Annual Report records that a group of men were engaged to camouflage the station against potential Japanese aerial bombing. The work included spraying over the concrete road with black bitumen, building a fake road across a nearby park, disguising the suction reservoir with hessian covering and marking out a dummy pumping station with smokestacks some three or four metres high on vacant land in Meadowbank. In addition, a temporary war-time emergency pumping station was installed in a concrete building along Victoria Road. The greater site was also camouflaged through the irregular planting of trees and shrubs to replicate a natural environment.



Illustrating a model of Station No1 and Station No 2 and reservoir being camouflaged. Uncertain if this was instigated as no evidence of camouflage paint on Station No.2.



Illustrating Station No 2 Economiser House being reinforced as wartime protection. (c1942).



Illustrating Emergency Pumping Station built on Victoria Road. (c1942).



Illustrating air raid shelter door in basement of Pump Hall in Pumping Station No. 2 (2002).

Two platforms were erected either end of the Boiler House roof as lookouts for aircraft during WWII and the two ladders leading up to these platforms are still in place. An air raid shelter was constructed to the west of the building near the valve pits. The entry to the shelter and a reinforcing low brick wall over the shelter are evident today.

The post-war housing shortage also affected *Ryde Water Pumping Station* as the engineer's house was converted into two flats. Two three bedroom self-contained apartments, one on each floor, were created for subsidiary Board staff.

Steam to Electrification

Steam power was predominantly used by the Board to pump water. Steam was also commonly used in early construction works at Potts Hill and for the Pressure Tunnel. Steam power reached its pinnacle in its use at Ryde Water Pumping Station. It was the last of the Board's plants to be powered by steam. Crown Street and Potts Hill, the other remaining steam powered water pumping stations had closed in the 1960s.

By the 1950s the debate over steam versus electricity gained momentum. The then President of the Water Board, Dr Upton's view was that '*special steam stations were somewhat of an anachronism.*' However dissenting views were held by the then Chief Mechanical Engineer (Mr Furness) and Board Member Alderman Campbell who stated that it would be '*an outrage to discard machinery still capable of useful service*'.

The electrification of the plant did not occur at this time. It is recorded the Board's vote was influenced by a power blackout during the time of deciding. The Board proceeded with installing a new steam plant in the upgrade of 1958-59.

In July 1972, the Board finally decided to convert Ryde Water Pumping Station to electric drive. The replacement plant was installed in the existing Pump House. This was done progressively until completion in 1981 when the steam was finally turned off. This marked the end of steam power being used by the Water Board.

Pumping units Nos. 3, 4, 5 and 6 (formerly units 5, 6, 7 and 8) were converted from steam power to electricity. The unique smells, sounds and atmosphere of the steam pumping station was described (and romanticised) in the Boards Journal at the time.

There are many manifestations of steam at Ryde – apart from the plant itself – that will remain in the mind's eye of its staff long after the electric motors and switchboards take over. Things like the peculiar sounds of steam plant, the smell of coaldust, oil and steam itself; the cosy warmth of the engine room and Boiler House on a cold winter's day; the glow of a furnace fire through an open grate; and many less romantic things, like the sight of a man casually heating his lunch on the casing of a steam turbine.

This article described the impact of the cessation of the steam plant:

The huge boilers, the turbines, condensers, economisers, the labyrinth of steam pipes and other paraphernalia of steam will go – much of it destined for the scrapyard. The three towering chimney stacks will come down; the two diesel locomotives, the bunkering shed, hoppers and other coal handling plant and the ash removal facilities will be equally redundant. There will be no more brass or copper gauges to be given a polished gleam; no more gearboxes to affect conversation; no more shrill blasts of the

steam whistle alarms signalling high or low boiler water. The sights, sounds and smells of steam operation will disappear.

Julian Clutterbuck, Engineer In Charge of Ryde (1987 - 2010) described the impact of technological change on the workforce as a gradual process. The changeover to electric power took several years and staff were re-trained for other roles within the Board. While the site may have physically contracted to keep pace with technological change, the role of Ryde Water Pumping Station in the Northern Water Distribution System continued to evolve and expand. The construction of the new control room enabled Ryde to carry out other functions for the Water Board including monitoring sewage pumping stations. The station also controlled and monitored the distribution of water to Pymble and Warringah.

The most significant change to the pumping station since electrification was the installation of remote control (Integrated, Instrumentation, Control, Automation and Telemetry System (IICATS)) in the mid-1990s. This allowed the station to be run remotely from Sydney Water's Head Office.

Moveable Heritage Elements and Machinery Components

There are few items recognised as being 'moveable heritage' remaining at the *Ryde Water Pumping Station*. Notable is the desk from Station No. 1 and a plaque from a boiler also from Station No.1 that are located in the old control room of Station No. 2.

Many brass gauges, drawings, ledgers and other artefacts remain at the site or are in storage that originate from the *Ryde Water Pumping Station*.

In general, the moveable heritage items from the *Ryde Water Pumping Station* will be managed in accordance with the Sydney Water's Moveable Heritage Policy and Procedures Manual. The moveable heritage items will be catalogued and retained on the Ryde site where ever possible.



Illustrating moveable heritage items, the desk and plaque of boiler (on wall above) from Station No1. (2014).



Illustrating moveable heritage items, ledgers and photos. (2014).

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Rogers, L: Non-recorded interview with Mr Colin Potter, former employee at Ryde Water Pumping Station for period of 25 years, on 17 February 2004.

Documentary evidence relating to Ryde Water Pumping Station is held at the following repositories:

- Ryde Library (Local Studies Section)
- Mitchell Wing, NSW State Library
- Sydney Water Archive
- Sydney Water Library

INTERPRETATION PLAN



Illustrating Station No. 2 – the official ‘opening’ in 1921: note the date on the building is 1919. (1921).

The interpretation of the Ryde Water Pumping Station will include the placement of the Heritage Marker at the site, a public ceremony to unveil the Marker and the installation (on a location to be determined) of an interpretation panel.

Interpretation Panel – the interpretation panel will be a sign that explains and illustrates the place. It needs to engage the user when explaining why the pumping station deserves the engineering heritage recognition (and the appropriate Marker).

The picture above of the opening ceremony in 1921 may be used in the panel as it illustrates the station when it opened and celebrates the event. The heritage recognition and the Marker are celebrating the importance of the station and the interpretation panel will reflect this aim.

Information contained in the interpretation panel will need to be mindful of the high security associated with the site and with Sydney Water’s messaging.



Illustrating rail viaduct leading into the coal staithe in the Boiler House. At the official opening with the first small 50hp oil locomotive. (1921).

Design process – the interpretation panel will be designed in accordance with Engineers Australia expectations and with final approval from Sydney Water.

Structure of panel – it is suggested that the interpretation panel will be attached to the building somewhere where it may be easily seen but does not damage the historic fabric of the place. Otherwise, a free standing sign on frame in accordance with previous engineering heritage recognition interpretation panels will be used, and likely located at the Victoria Road frontage of the building.

Content – the content contained on the interpretation panel will be one or two historic photographs, a maps and a small amount of text. The history of the site including station number 1 will be included. Possibly an abbreviated Statement of Significance could also be included.

ASSESSMENT OF CATEGORY OF AWARD

Assessment of Engineering Heritage Significance of Ryde Water Pumping Station.

Historical Significance	Indicate 'Agree' or leave blank	
	National or State heritage significant	Other than National or State heritage significant
<i>Guidelines for inclusion</i>		
Shows evidence of a significant human activity.	Agree	
Is associated with a significant activity or historical phase.	Agree	
Maintains or shows the continuity of a historical process or activity.	Agree	
<i>Guidelines for exclusion</i>		
Has incidental or unsubstantiated connections with historically important activities or processes.		
Provides evidence of activities or processes that are of dubious importance.		
Has been so altered that it can no longer provide evidence of a particular association		
Historic Individuals or Association		
<i>Guidelines for inclusion</i>		
Shows evidence of a significant human occupation.	Agree	
Is associated with a significant event, person, or group of persons.		
<i>Guidelines for exclusion</i>		
Has incidental or unsubstantiated connections with historically important people or events.		
Provides evidence of people or events that are of dubious historical importance		
Has been so altered that it can no longer provide evidence of particular association.		
Creative or Technical Achievement		
<i>Guidelines for inclusion</i>		
Shows or is associated with, creative or technical innovation or achievement.	Agree	
Is aesthetically distinctive.	Agree	
Has landmark qualities.	Agree	
Exemplifies a particular taste, style, or technology.	Agree	
<i>Guidelines for exclusion</i>		
Is not a major work by an important designer or artist.		

Has lost its design or technical integrity. Its visual or sensory appeal or landmark qualities have been more than temporarily downgraded.		
Has only a loose association with a creative or technical achievement.		
Research Potential		
Guidelines for inclusion		
Has the potential to yield new or further substantial scientific and/or archaeological information.	Agree	
Is an important benchmark or reference site or type. Provides evidence of past human cultures that is unavailable.	Agree Agree	
Guidelines for exclusion		
Has little archaeological or research potential. Only contains information that is readily available from other resources or archaeological sites. The knowledge gained would be irrelevant to research, human history, or culture.		
Social		
Guidelines for inclusion		
Is important for its association with an identifiable group.		
Is important to a community's sense of place.	Agree	
Guidelines for exclusion		
Is only important to the community for amenity reasons.		
Rarity		
Guidelines for inclusion		
Provides evidence of a defunct custom, way of life or process.	Agree	
Shows unusually accurate evidence of a significant human activity. Is the only example of its type	Agree	
Demonstrates designs or techniques of exceptional interest. Shows rare evidence of a significant human activity important to a community.	Agree Agree	
Guidelines for exclusion		
Is not rare. Is numerous but under threat		
Representativeness		
Guidelines for inclusion		
Is a fine example of its type Has the principal characteristics of an important class or group of items.	Agree Agree	
Has attributes typical of a particular way of life, philosophy, custom, significant process, design, technique or activity.	Agree	

Is a significant variation to a class of item	Agree	
Is part of a group which collectively illustrates a representative type	Agree	
Is outstanding because of its setting, condition or size.	Agree	
Is outstanding because of its integrity or the esteem in which it is held.	Agree	
<i>Guidelines for exclusion</i>		
Is a poor example of its type		
Does not include or has lost the range of characteristics of a type.		
Does not represent well the characteristics that make up a significant variation of a type.		

APPENDIX 1.

Letter of support from owner

APPENDIX 2.

Chronological history (1891-1991) prepared by C & MJ Doring Pty Ltd of both the pumping and steam plant utilised at Pumping Station No.2.

APPENDIX 3.

Pierce, E. W. T. Ryde Pumping Station, Sydney Water Board Journal Volume 9 No.2 July 1959

APPENDIX 4.

Heritage listings for Ryde Water Pumping Station